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AN

INQUIRY

INTO THE

HUMAN MIND,

ON THE PRINCIPLES OF

COMMON SENSE.

BY

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The Inſpiration of the Almighty giveth them Underſtanding.

JOB.

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TO

THE RIGHT HONOURABLE

JAMES, Earl of FINDLATER and SEAFIELD,

CHANCELLOR OF THE UNIVERSITY OF OLD ABERDEEN.

My Lord,

THOUGH I apprehend that there are things new, and of ſome importance, in the following inquiry, it is not without timidity that I have conſented to the publication of it. The ſubject has been canvaſſed by men of very great penetration and genius: for who does not acknowledge Des Cartes, Malebranche, Locke, Berkeley, and Hume, to be ſuch? A view of the human underſtanding, ſo different from that which they have exhibited, will, no doubt, be condemned by many without examination, as proceeding from temerity and vanity.

But I hope the candid and diſcerning Few, who are capable of attending to the operations of their own minds, will weigh deliberately what is here advanced, before they paſs ſentence upon it. To ſuch I appeal, as the only competent judges. If they diſapprove, I am probably in the wrong, and ſhall be ready to change my opinion upon conviction. If they approve, the Many will at laſt yield to their authority, as they always do.

However contrary my notions are to thoſe of the writers I have mentioned, their ſpeculations have been of great uſe to me, and ſeem even to point out the road which I have taken; and your Lordſhip knows, that the merit of uſeful diſcoveries is ſometimes not more juſtly due to thoſe that have hit upon them, than to others who have ripened them, and brought them to the birth.

I acknowledge, my Lord, that I never thought of calling in queſtion the principles commonly received with regard to the human

man underſtanding, until the *Treatiſe of Human Nature* was publiſhed, in the year 1739. The ingenious author of that treatiſe, upon the principles of LOCKE, who was no ſceptic, hath built a ſyſtem of ſcepticiſm, which leaves no ground to believe any one thing rather than its contrary. His reaſoning appeared to me to be juſt: there was therefore a neceſſity to call in queſtion the principles upon which it was founded, or to admit the concluſion.

BUT can any ingenious mind admit this ſceptical ſyſtem without reluctance? I truly could not, my Lord: for I am perſuaded, that abſolute ſcepticiſm is not more deſtructive of the faith of a Chriſtian, than of the ſcience of a philoſopher, and of the prudence of a man of common underſtanding. I am perſuaded, that the unjuſt *live by faith* as well as the *juſt;* that, if all belief could be laid aſide, piety, patriotiſm, friendſhip, parental affection, and private virtue, would appear as ridiculous as

knight-errantry; and that the purſuits of pleaſure, of ambition, and of avarice, muſt be grounded upon belief, as well as thoſe that are honourable or virtuous.

The day-labourer toils at his work, in the belief that he ſhall receive his wages at night; and if he had not this belief, he would not toil. We may venture to ſay, that even the author of this ſceptical ſyſtem, wrote it in the belief that it ſhould be read and regarded. I hope he wrote it in the belief alſo, that it would be uſeful to mankind: and perhaps it may prove ſo at laſt. For I conceive the ſceptical writers to be a ſet of men, whoſe buſineſs it is, to pick holes in the fabrick of knowledge wherever it is weak and faulty; and when theſe places are properly repaired, the whole building becomes more firm and ſolid than it was formerly.

For my own ſatisfaction, I entered into a ſerious examination of the principles upon which this ſceptical ſyſtem is built; and was not

not a little ſurpriſed to find, that, it leans with its whole weight upon a hypotheſis, which is ancient indeed, and hath been very generally received by philoſophers, but of which I could find no ſolid proof. The hypotheſis I mean is, That nothing is perceived but what is in the mind which perceives it: That we do not really perceive things that are external, but only certain images and pictures of them imprinted upon the mind, which are called *impreſſions* and *ideas*.

If this be true; ſuppoſing certain impreſſions and ideas to exiſt in my mind, I cannot, from their exiſtence, infer the exiſtence of any thing elſe; my impreſſions and ideas are the only exiſtences of which I can have any knowledge or conception; and they are ſuch fleeting and tranſitory beings, that they can have no exiſtence at all, any longer than I am conſcious of them. So that, upon this hypotheſis, the whole univerſe about me, bodies and ſpirits, ſun, moon, ſtars, and earth, friends and relations, all things without exception,

ception, which I imagined to have a permanent exiſtence, whether I thought of them or not, vaniſh at once;

And, like the baſeleſs fabric of a viſion,
Leave not a track behind.

I THOUGHT it unreaſonable, my Lord, upon the authority of philoſophers, to admit a hypotheſis, which, in my opinion, overturns all philoſophy, all religion and virtue, and all common ſenſe: and finding that all the ſyſtems concerning the human underſtanding which I was acquainted with, were built upon this hypotheſis, I reſolved to inquire into this ſubject anew, without regard to any hypotheſis.

WHAT I now humbly preſent to your Lordſhip, is the fruit of this inquiry, ſo far only as it regards the five ſenſes; in which I claim no other merit, than that of having given great attention to the operations of my own mind, and of having expreſſed, with all the

the perſpicuity I was able, what I conceive every man, who gives the ſame attention, will feel and perceive. The productions of imagination, require a genius which ſoars above the common rank; but the treaſures of knowledge are commonly buried deep, and may be reached by thoſe drudges who can dig with labour and patience, though they have not wings to fly. The experiments that were to be made in this inveſtigation ſuited me, as they required no other expence, but that of time and attention, which I could beſtow. The leiſure of an academical life, diſengaged from the purſuits of intereſt and ambition; the duty of my profeſſion, which obliged me to give prelections on theſe ſubjects to the youth; and an early inclination to ſpeculations of this kind,—have enabled me, as I flatter myſelf, to give a more minute attention to the ſubject of this inquiry, than has been given before.

My thoughts upon this ſubject were, a good many years ago, put together in another form,

form, for the uſe of my pupils; and afterwards were ſubmitted to the judgment of a private philoſophical ſociety, of which I have the honour to be a member. A great part of this inquiry was honoured even by your Lordſhip's peruſal. And the encouragement which you, my Lord, and others, whoſe friendſhip is my boaſt, and whoſe judgment I reverence, were pleaſed to give me, counterbalanced my timidity and diffidence, and determined me to offer it to the public.

If it appears to your Lordſhip to juſtify the common ſenſe and reaſon of mankind, againſt the ſceptical ſubtilties which, in this age, have endeavoured to put them out of countenance; if it appears to throw any new light upon one of the nobleſt parts of the divine workmanſhip; your Lordſhip's reſpect for the arts and ſciences, and your attention to every thing which tends to the improvement of them, as well as to every thing elſe that contributes to the felicity of your country, leave me no room to doubt of your favourable

vourable acceptance of this eſſay, as the fruit of my induſtry in a profeſſion wherein I was accountable to your Lordſhip; and as a teſtimony of the great eſteem and reſpect wherewith I have the honour to be,

My Lord,

Your Lordship's

moſt obliged, and

moſt devoted ſervant,

THO. REID.

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AN

INQUIRY

INTO THE

HUMAN MIND.

CHAP. I.

INTRODUCTION.

SECT. I.

The importance of the ſubject, and the means of proſecuting it.

THE fabric of the human mind is curious and wonderful, as well as that of the human body. The faculties of the one are with no leſs wiſdom adapted to their ſeveral ends, than the organs of the other. Nay, it is reaſonable to think, that as the mind is a nobler work, and of a higher or-

der than the body, even more of the wiſdom and ſkill of the Divine Architect hath been employed in its ſtructure. It is therefore a ſubject highly worthy of inquiry on its own account, but ſtill more worthy on account of the extenſive influence which the knowledge of it hath over every other branch of ſcience.

In the arts and ſciences which have leaſt connection with the mind, its faculties are the engines which we muſt employ; and the better we underſtand their nature and uſe, their defects and diſorders, the more ſkilfully we ſhall apply them, and with the greater ſucceſs. But in the nobleſt arts, the mind is alſo the ſubject upon which we operate. The painter, the poet, the actor, the orator, the moraliſt, and the ſtateſman, attempt to operate upon the mind in different ways, and for different ends; and they ſucceed, according as they touch properly the ſtrings of the human frame. Nor can their ſeveral arts ever ſtand on a ſolid foundation, or riſe to the dignity of ſcience, until they are built on the principles of the human conſtitution.

Wiſe men now agree, or ought to agree in this, that there is but one way to the knowledge

knowledge of Nature's works; the way of obſervation and experiment. By our conſtitution, we have a ſtrong propenſity to trace particular facts and obſervations to general rules, and to apply ſuch general rules to account for other effects, or to direct us in the production of them. This procedure of the underſtanding is familiar to every human creature in the common affairs of life, and it is the only one by which any real diſcovery in philoſophy can be made.

The man who firſt diſcovered that cold freezes water, and that heat turns it into vapour, proceeded on the ſame general principles, and in the ſame method, by which NEWTON diſcovered the law of gravitation, and the properties of light. His *regulæ philoſophandi* are maxims of common ſenſe, and are practiſed every day in common life; and he who philoſophizes by other rules, either concerning the material ſyſtem, or concerning the mind, miſtakes his aim.

Conjectures and theories are the creatures of men, and will always be found very unlike the creatures of GOD. If we would know the works of GOD, we muſt conſult themſelves with attention and humility, without daring to add any thing of ours to what they declare. A juſt interpretation of nature is the

only ſound and orthodox philoſophy: whatever we add of our own, is apocryphal, and of no authority.

All our curious theories of the formation of the earth, of the generation of animals, of the origin of natural and moral evil, ſo far as they go beyond a juſt induction from facts, are vanity and folly, no leſs than the vortices of DES CARTES, or the Archæus of PARACELSUS. Perhaps the philoſophy of the mind hath been no leſs adulterated by theories, than that of the material ſyſtem. The theory of ideas is indeed very ancient, and hath been very univerſally received; but as neither of theſe titles can give it authenticity, they ought not to ſcreen it from a free and candid examination; eſpecially in this age, when it hath produced a ſyſtem of ſcepticiſm, that ſeems to triumph over all ſcience, and even over the dictates of common ſenſe.

All that we know of the body, is owing to anatomical diſſection and obſervation, and it muſt be by an anatomy of the mind that we can diſcover its powers and principles.

SECT.

SECT. II.

The impediments to our knowledge of the mind.

BUT it muſt be acknowledged, that this kind of anatomy is much more difficult than the other; and therefore it needs not ſeem ſtrange, that mankind have made leſs progreſs in it. To attend accurately to the operations of our minds, and make them an object of thought, is no eaſy matter even to the contemplative, and to the bulk of mankind is next to impoſſible.

An anatomiſt who hath happy opportunities, may have acceſs to examine with his own eyes, and with equal accuracy, bodies of all different ages, ſexes, and conditions; ſo that what is defective, obſcure, or preternatural in one, may be diſcerned clearly, and in its moſt perfect ſtate, in another. But the anatomiſt of the mind cannot have the ſame advantage. It is his own mind only that he can examine, with any degree of accuracy and diſtinctneſs. This is the only ſubject he can look into. He may, from outward ſigns, collect the operations of other minds; but theſe ſigns are for the moſt part

ambiguous, and muſt be interpreted by what he perceives within himſelf.

So that if a philoſopher could delineate to us, diſtinctly and methodically, all the operations of the thinking principle within him, which no man was ever able to do, this would be only the anatomy of one particular ſubject; which would be both deficient and erroneous, if applied to human nature in general. For a little reflection may ſatisfy us, that the difference of minds is greater than that of any other beings which we conſider as of the ſame ſpecies.

Of the various powers and faculties we poſſeſs, there are ſome which nature ſeems both to have planted and reared, ſo as to have left nothing to human induſtry. Such are the powers which we have in common with the brutes, and which are neceſſary to the preſervation of the individual, or the continuance of the kind. There are other powers, of which nature hath only planted the ſeeds in our minds, but hath left the rearing of them to human culture. It is by the proper culture of theſe that we are capable of all thoſe improvements in intellectuals, in taſte, and in morals, which exalt and dignify human nature; while, on the other hand, the neglect

neglect or perverſion of them makes its degeneracy and corruption.

The two-legged animal that eats of nature's dainties, what his taſte or appetite craves, and ſatisfies his thirſt at the cryſtal fountain, who propagates his kind as occaſion and luſt prompt, repels injuries, and takes alternate labour and repoſe, is, like a tree in the foreſt, purely of nature's growth. But this ſame ſavage hath within him the ſeeds of the logician, the man of taſte and breeding, the orator, the ſtateſman, the man of virtue, and the ſaint; which ſeeds, though planted in his mind by nature, yet, through want of culture and exerciſe, muſt lie for ever buried, and be hardly perceivable by himſelf or by others.

The loweſt degree of ſocial life will bring to light ſome of thoſe principles which lay hid in the ſavage ſtate: and according to his training, and company, and manner of life, ſome of them, either by their native vigour, or by the force of culture, will thrive and grow up to great perfection; others will be ſtrangely perverted from their natural form; and others checked, or perhaps quite eradicated.

This makes human nature ſo various and multiform in the individuals that partake of it, that, in point of morals, and intellectual endowments, it fills up all that gap which we conceive to be between brutes and devils below, and the celeſtial orders above; and ſuch a prodigious diverſity of minds muſt make it extremely difficult to diſcover the common principles of the ſpecies.

The language of philoſophers, with regard to the original faculties of the mind, is ſo adapted to the prevailing ſyſtem, that it cannot fit any other; like a coat that fits the man for whom it was made, and ſhows him to advantage, which yet will ſit very awkward upon one of a different make, although perhaps as handſome and as well proportioned. It is hardly poſſible to make any innovation in our philoſophy concerning the mind and its operations, without uſing new words and phraſes, or giving a different meaning to thoſe that are received; a liberty which, even when neceſſary, creates prejudice and miſconſtruction, and which muſt wait the ſanction of time to authoriſe it. For innovations in language, like thoſe in religion and government, are always ſuſpected and diſliked by the many,

ny, till uſe hath made them familiar, and preſcription hath given them a title.

If the original perceptions and notions of the mind were to make their appearance ſingle and unmixed, as we firſt received them from the hand of nature, one accuſtomed to reflection would have leſs difficulty in tracing them; but before we are capable of reflection, they are ſo mixed, compounded and decompounded, by habits, aſſociations, and abſtractions, that it is hard to know what they were originally. The mind may in this reſpect be compared to an apothecary or a chemiſt, whoſe materials indeed are furniſhed by nature; but for the purpoſes of his art, he mixes, compounds, diſſolves, evaporates, and ſublimes them, till they put on a quite different appearance; ſo that it is very difficult to know what they were at firſt, and much more to bring them back to their original and natural form. And this work of the mind is not carried on by deliberate acts of mature reaſon, which we might recollect, but by means of inſtincts, habits, aſſociations, and other principles, which operate before we come to the uſe of reaſon; ſo that it is extremely difficult for the mind to return upon its own footſteps, and trace back thoſe operations

tions which have employed it ſince it firſt began to think and to act.

Could we obtain a diſtinct and full hiſtory of all that hath paſſed in the mind of a child, from the beginning of life and ſenſation, till it grows up to the uſe of reaſon; how its infant faculties began to work, and how they brought forth and ripened all the various notions, opinions, and ſentiments, which we find in ourſelves when we come to be capable of reflection; this would be a treaſure of natural hiſtory, which would probably give more light into the human faculties, than all the ſyſtems of philoſophers about them ſince the beginning of the world. But it is in vain to wiſh for what nature has not put within the reach of our power. Reflection, the only inſtrument by which we can diſcern the powers of the mind, comes too late to obſerve the progreſs of nature, in raiſing them from their infancy to perfection.

It muſt therefore require great caution, and great application of mind, for a man that is grown up in all the prejudices of education, faſhion, and philoſophy, to unravel his notions and opinions, till he finds out the ſimple and original principles of his conſtitution, of which no account can be given but the will

will of our Maker. This may be truly called an *analyſis* of the human faculties; and till this is performed, it is in vain we expect any juſt *ſyſtem* of the mind; that is, an enumeration of the original powers and laws of our conſtitution, and an explication from them of the various phenomena of human nature.

Succeſs in an inquiry of this kind, it is not in human power to command; but perhaps it is poſſible, by caution and humility, to avoid error and deluſion. The labyrinth may be too intricate, and the thread too fine, to be traced through all its windings; but if we ſtop where we can trace it no further, and ſecure the ground we have gained, there is no harm done; a quicker eye may in time trace it further.

It is genius, and not the want of it, that adulterates philoſophy, and fills it with error and falſe theory. A creative imagination diſdains the mean offices of digging for a foundation, of removing rubbiſh, and carrying materials: leaving theſe ſervile employments to the drudges in ſcience, it plans a deſign, and raiſes a fabric. Invention ſupplies materials where they are wanting, and fancy adds colouring, and every befitting ornament. The work pleaſes the eye, and wants nothing but

but ſolidity and a good foundation. It ſeems even to vie with the works of nature; till ſome ſucceeding architect blows it into rubbiſh, and builds as goodly a fabric of his own in its place. Happily for the preſent age, the caſtle-builders employ themſelves more in romance than in philoſophy. That is undoubtedly their province, and in thoſe regions the offspring of fancy is legitimate; but in philoſophy it is all ſpurious.

SECT. III.

The preſent ſtate of this part of philoſophy.— Of Des Cartes, Malebranche, and Locke.

THAT our philoſophy concerning the mind and its faculties, is but in a very low ſtate, may be reaſonably conjectured, even by thoſe who never have narrowly examined it. Are there any principles with regard to the mind, ſettled with that perſpicuity and evidence, which attends the principles of mechanics, aſtronomy, and optics? Theſe are really ſciences built upon laws of nature which univerſally obtain. What is diſcovered in them, is no longer matter of diſpute: future ages may add to it, but till the courſe of

of nature be changed, what is already eſtabliſhed can never be overturned. But when we turn our attention inward, and conſider the phenomena of human thoughts, opinions, and perceptions, and endeavour to trace them to the general laws and the firſt principles of our conſtitution, we are immediately involved in darkneſs and perplexity. And if common ſenſe, or the principles of education, happen not to be ſtubborn, it is odds but we end in abſolute ſcepticiſm.

DES CARTES finding nothing eſtabliſhed in this part of philoſophy, in order to lay the foundation of it deep, reſolved not to believe his own exiſtence till he ſhould be able to give a good reaſon for it. He was, perhaps, the firſt that took up ſuch a reſolution: but if he could indeed have effected his purpoſe, and really become diffident of his exiſtence, his caſe would have been deplorable, and without any remedy from reaſon or philoſophy. A man that diſbelieves his own exiſtence, is ſurely as unfit to be reaſoned with, as a man that believes he is made of glaſs. There may be diſorders in the human frame that may produce ſuch extravagancies; but they will never be cured by reaſoning. DES CARTES indeed would make us believe, that

that he got out of this delirium by this logical argument, *Cogito, ergo ſum.* But it is evident he was in his ſenſes all the time, and never ſeriouſly doubted of his exiſtence. For he takes it for granted in this argument, and proves nothing at all. I am thinking, ſays he, therefore I am: and is it not as good reaſoning to ſay, I am ſleeping, therefore I am? or, I am doing nothing, therefore I am? If a body moves, it muſt exiſt, no doubt; but if it is at reſt, it muſt exiſt likewiſe.

Perhaps DES CARTES meant not to aſſume his own exiſtence in this enthymeme, but the exiſtence of thought; and to infer from that the exiſtence of a mind, or ſubject of thought. But why did he not prove the exiſtence of his thought? Conſciouſneſs, it may be ſaid, vouches that. But who is voucher for conſciouſneſs? Can any man prove that his conſciouſneſs may not deceive him? No man can: nor can we give a better reaſon for truſting to it, than that every man, while his mind is ſound, is determined, by the conſtitution of his nature, to give implicit belief to it, and to laugh at, or pity, the man who doubts its teſtimony. And is not every man, in his wits, as much determined to take his exiſtence upon truſt as his conſciouſneſs?

The

The other propoſition aſſumed in this argument, That thought cannot be without a mind or ſubject, is liable to the ſame objection: not that it wants evidence; but that its evidence is no clearer, nor more immediate, than that of the propoſition to be proved by it. And taking all theſe propoſitions together,—I think,—I am conſcious,—Every thing that thinks, exiſts,—I exiſt,—would not every ſober man form the ſame opinion of the man who ſeriouſly doubted any one of them? And if he was his friend, would he not hope for his cure from phyſic and good regimen, rather than from metaphyſic and logic?

But ſuppoſing it proved, that my thought and my conſciouſneſs muſt have a ſubject, and conſequently that I exiſt, how do I know that all that train and ſucceſſion of thoughts which I remember, belong to one ſubject, and that the I of this moment, is the very individual I of yeſterday, and of times paſt?

DES CARTES did not think proper to ſtart this doubt: but LOCKE has done it; and, in order to reſolve it, gravely determines, that perſonal identity conſiſts in conſciouſneſs; that is, if you are conſcious that you did ſuch a thing a twelvemonth ago, this conſciouſneſs makes

makes you to be the very perſon that did it. Now, conſciouſneſs of what is paſt, can ſignify nothing elſe but the remembrance that I did it. So that LOCKE's principle muſt be, That identity conſiſts in remembrance; and conſequently a man muſt loſe his perſonal identity with regard to every thing he forgets.

Nor are theſe the only inſtances whereby our philoſophy concerning the mind appears to be very fruitful in creating doubts, but very unhappy in reſolving them.

DES CARTES, MALEBRANCHE, and LOCKE, have all employed their genius and ſkill, to prove the exiſtence of a material world; and with very bad ſucceſs. Poor untaught mortals believe undoubtedly, that there is a ſun, moon, and ſtars; an earth, which we inhabit; country, friends, and relations, which we enjoy; land, houſes, and moveables, which we poſſeſs. But philoſophers, pitying the credulity of the vulgar, reſolve to have no faith but what is founded upon reaſon. They apply to philoſophy to furniſh them with reaſons for the belief of thoſe things, which all mankind have believed without being able to give any reaſon for it. And ſurely one would expect, that, in matters of ſuch importance, the proof would

would not be difficult: but it is the moſt difficult thing in the world. For theſe three great men, with the beſt good will, have not been able, from all the treaſures of philoſophy, to draw one argument, that is fit to convince a man that can reaſon, of the exiſtence of any one thing without him. Admired Philoſophy! daughter of light! parent of wiſdom and knowledge! if thou art ſhe! ſurely thou haſt not yet ariſen upon the human mind, nor bleſſed us with more of thy rays, than are ſufficient to ſhed a "darkneſs viſible" upon the human faculties, and to diſturb that repoſe and ſecurity which happier mortals enjoy, who never approached thine altar, nor felt thine influence! But if indeed thou haſt not power to diſpel thoſe clouds and phantoms which thou haſt diſcovered or created, withdraw this penurious and malignant ray: I deſpiſe Philoſophy, and renounce its guidance: let my ſoul dwell with Common Senſe.

SECT. IV.

Apology for thoſe philoſophers.

BUT inſtead of deſpiſing the dawn of light, we ought rather to hope for its increaſe: inſtead of blaming the philoſophers I have mentioned, for the defects and blemiſhes of their ſyſtem, we ought rather to honour their memories, as the firſt diſcoverers of a region in philoſophy formerly unknown; and, however lame and imperfect the ſyſtem may be, they have opened the way to future diſcoveries, and are juſtly entitled to a great ſhare in the merit of them. They have removed an infinite deal of ruſt and rubbiſh, collected in the ages of ſcholaſtic ſophiſtry, which had obſtructed the way. They have put us in the right road, that of experience and accurate reflection. They have taught us to avoid the ſnares of ambiguous and ill-defined words, and have ſpoken and thought upon this ſubject with a diſtinctneſs and perſpicuity formerly unknown. They have made many openings that may lead to the diſcovery of truths which they did not reach, or to the detection

tection of errors in which they were involuntarily entangled.

It may be obſerved, that the defects and blemiſhes in the received philoſophy concerning the mind, which have moſt expoſed it to the contempt and ridicule of ſenſible men, have chiefly been owing to this;—that the votaries of this philoſophy, from a natural prejudice in her favour, have endeavoured to extend her juriſdiction beyond its juſt limits, and to call to her bar the dictates of Common Senſe. But theſe decline this juriſdiction; they diſdain the trial of reaſoning, and diſown its authority; they neither claim its aid, nor dread its attacks.

In this unequal conteſt betwixt Common Senſe and Philoſophy, the latter will always come off both with diſhonour and loſs; nor can ſhe ever thrive till this rivalſhip is dropt, theſe encroachments given up, and a cordial friendſhip reſtored: for, in reality, Common Senſe holds nothing of Philoſophy, nor needs her aid. But, on the other hand, Philoſophy (if I may be permitted to change the metaphor) has no other root but the principles of Common Senſe; it grows out of them, and draws its nouriſhment from them: ſevered

from this root, its honours wither, its ſap is dried up, it dies and rots.

The philoſophers of the laſt age, whom I have mentioned, did not attend to the preſerving this union and ſubordination ſo carefully as the honour and intereſt of philoſophy required: but thoſe of the preſent have waged open war with Common Senſe, and hope to make a complete conqueſt of it by the ſubtilties of Philoſophy; an attempt no leſs audacious and vain, than that of the giants to dethrone almighty Jove.

SECT.

SECT. V.

Of Biſhop Berkeley; the Treatiſe of Human Nature; and of ſcepticiſm.

THE preſent age, I apprehend, has not produced two more acute or more practiſed in this part of philoſophy, than the Biſhop of Cloyne, and the author of the *Treatiſe of Human Nature*. The firſt was no friend to ſcepticiſm, but had that warm concern for religious and moral principles which became his order: yet the reſult of his inquiry was, a ſerious conviction, that there is no ſuch thing as a material world; nothing in nature but ſpirits and ideas; and that the belief of material ſubſtances, and of abſtract ideas, are the chief cauſes of all our errors in philoſophy, and of all infidelity and hereſy in religion. His arguments are founded upon the principles which were formerly laid down by DES CARTES, MALEBRANCHE, and LOCKE, and which have been very generally received.

And the opinion of the ableſt judges ſeems to be, that they neither have been, nor can be confuted; and that he hath proved, by unan-

ſwerable arguments, what no man in his ſenſes can believe.

The ſecond proceeds upon the ſame principles, but carries them to their full length; and as the Biſhop undid the whole material world, this author, upon the ſame grounds, undoes the world of ſpirits, and leaves nothing in nature but ideas and impreſſions, without any ſubject on which they may be impreſſed.

It ſeems to be a peculiar ſtrain of humour in this author, to ſet out in his introduction, by promiſing, with a grave face, no leſs than a complete ſyſtem of the ſciences, upon a foundation entirely new, to wit, that of human nature; when the intention of the whole work is to ſhew, that there is neither human nature nor ſcience in the world. It may perhaps be unreaſonable to complain of this conduct in an author, who neither believes his own exiſtence, nor that of his reader; and therefore could not mean to diſappoint him, or to laugh at his credulity. Yet I cannot imagine, that the author of the *Treatiſe of Human Nature* is ſo ſceptical as to plead this apology. He believed, againſt his principles, that he ſhould be read, and that he ſhould retain his perſonal identity, till he reaped the honour

honour and reputation juſtly due to his metaphyſical *acumen*. Indeed, he ingenuouſly acknowledges, that it was only in ſolitude and retirement that he could yield any aſſent to his own philoſophy; ſociety, like day-light, diſpelled the darkneſs and fogs of ſcepticiſm, and made him yield to the dominion of Common Senſe. Nor did I ever hear him charged with doing any thing, even in ſolitude, that argued ſuch a degree of ſcepticiſm as his principles maintain. Surely if his friends apprehended this, they would have the charity never to leave him alone.

PYRRHO the Elean, the father of this philoſophy, ſeems to have carried it to greater perfection than any of his ſucceſſors: for if we may believe ANTIGONUS the Caryſtian, quoted by DIOGENES LAERTIUS, his life correſponded to his doctrine. And therefore, if a cart run againſt him, or a dog attacked him, or if he came upon a precipice, he would not ſtir a foot to avoid the danger, giving no credit to his ſenſes. But his attendants, who, happily for him, were not ſo great ſceptics, took care to keep him out of harm's way; ſo that he lived till he was ninety years of age. Nor is it to be doubted, but this author's friends would have been equally careful to keep him

from harm, if ever his principles had taken too ſtrong a hold of him.

It is probable the *Treatiſe of Human Nature* was not written in company; yet it contains manifeſt indications, that the author every now and then relapſed into the faith of the vulgar, and could hardly, for half a dozen pages, keep up the ſceptical character.

In like manner, the great PYRRHO himſelf forgot his principles on ſome occaſions; and is ſaid once to have been in ſuch a paſſion with his cook, who probably had not roaſted his dinner to his mind, that with the ſpit in his hand, and the meat upon it, he purſued him even into the market-place.

It is a bold philoſophy that rejects, without ceremony, principles which irreſiſtibly govern the belief and the conduct of all mankind in the common concerns of life; and to which the philoſopher himſelf muſt yield, after he imagines he hath confuted them. Such principles are older, and of more authority, than Philoſophy: ſhe reſts upon them as her baſis, not they upon her. If ſhe could overturn them, ſhe muſt be buried in their ruins; but all the engines of philoſophical ſubtilty are too weak for this purpoſe; and the attempt is no leſs ridiculous, than if a mechanic ſhould contrive

contrive an *axis in peritrochio* to remove the earth out of its place; or if a mathematician ſhould pretend to demonſtrate, that things equal to the ſame thing are not equal to one another.

ZENO endeavoured to demonſtrate the impoſſibility of motion; HOBBES, that there was no difference between right and wrong; and this author, that no credit is to be given to our ſenſes, to our memory, or even to demonſtration. Such philoſophy is juſtly ridiculous, even to thoſe who cannot detect the fallacy of it. It can have no other tendency, than to ſhew the acuteneſs of the ſophiſt, at the expence of diſgracing reaſon and human nature, and making mankind Yahoos.

SECT.

SECT. VI.

Of the Treatiſe of Human Nature.

THERE are other prejudices againſt this ſyſtem of human nature, which, even upon a general view, may make one diffident of it.

DES CARTES, HOBBES, and this author, have each of them given us a ſyſtem of human nature; an undertaking too vaſt for any one man, how great ſoever his genius and abilities may be. There muſt ſurely be reaſon to apprehend, that many parts of human nature never came under their obſervation; and that others have been ſtretched and diſtorted, to fill up blanks, and complete the ſyſtem. CHRISTOPHER COLUMBUS, or SEBASTIAN CABOT, might almoſt as reaſonably have undertaken to give us a complete map of America.

There is a certain character and ſtyle in nature's works, which is never attained in the moſt perfect imitation of them. This ſeems to be wanting in the ſyſtems of human nature I have mentioned, and particularly in the laſt. One may ſee a puppet make variety of motions and geſticulations, which ſtrike much

much at firſt view; but when it is accurately obſerved, and taken to pieces, our admiration ceaſes; we comprehend the whole art of the maker. How unlike is it to that which it repreſents! what a poor piece of work compared with the body of a man, whoſe ſtructure the more we know, the more wonders we diſcover in it, and the more ſenſible we are of our ignorance! Is the mechaniſm of the mind ſo eaſily comprehended, when that of the body is ſo difficult? Yet, by this ſyſtem, three laws of aſſociation, joined to a few original feelings, explain the whole mechaniſm of ſenſe, imagination, memory, belief, and of all the actions and paſſions of the mind. Is this the man that nature made? I ſuſpect it is not ſo eaſy to look behind the ſcenes in nature's work. This is a puppet ſurely, contrived by too bold an apprentice of nature, to mimic her work. It ſhews tolerably by candle-light, but brought into clear day, and taken to pieces, it will appear to be a man made with mortar and a trowel. The more we know of other parts of nature, the more we like and approve them. The little I know of the planetary ſyſtem; of the earth which we inhabit; of minerals, vegetables, and animals; of my own body, and of the laws

laws which obtain in theſe parts of nature; opens to my mind grand and beautiful ſcenes, and contributes equally to my happineſs and power. But when I look within, and conſider the mind itſelf, which makes me capable of all theſe proſpects and enjoyments; if it is indeed what the *Treatiſe of Human Nature* makes it, I find I have been only in an inchanted caſtle, impoſed upon by ſpectres and apparitions. I bluſh inwardly to think how I have been deluded; I am aſhamed of my frame, and can hardly forbear expoſtulating with my deſtiny: Is this thy paſtime, O Nature, to put ſuch tricks upon a ſilly creature, and then to take off the maſk, and ſhew him how he hath been befooled? If this is the philoſophy of human nature, my ſoul enter thou not into her ſecrets. It is ſurely the forbidden tree of knowledge; I no ſooner taſte of it, than I perceive myſelf naked, and ſtript of all things, yea even of my very ſelf. I ſee myſelf, and the whole frame of nature, ſhrink into fleeting ideas, which, like EPICURUS's atoms, dance about in emptineſs.

SECT.

SECT. VII.

The ſyſtem of all theſe authors is the ſame, and leads to ſcepticiſm.

BUT what if theſe profound diſquiſitions into the firſt principles of human nature, do naturally and neceſſarily plunge a man into this abyſs of ſcepticiſm? May we not reaſonably judge ſo from what hath happened? DES CARTES no ſooner began to dig in this mine, than ſcepticiſm was ready to break in upon him. He did what he could to ſhut it out. MALEBRANCHE and LOCKE, who dug deeper, found the difficulty of keeping out this enemy ſtill to increaſe; but they laboured honeſtly in the deſign. Then BERKELEY, who carried on the work, deſpairing of ſecuring all, bethought himſelf of an expedient: By giving up the material world, which he thought might be ſpared without loſs, and even with advantage, he hoped, by an impregnable partition, to ſecure the world of ſpirits. But, alas! the *Treatiſe of Human Nature* wantonly ſapped the foundation of this partition, and drowned all in one univerſal deluge.

Theſe

Theſe facts, which are undeniable, do indeed give reaſon to apprehend, that DES CARTES's ſyſtem of the human underſtanding, which I ſhall beg leave to call *the ideal ſyſtem*, and which, with ſome improvements made by later writers, is now generally received, hath ſome original defect; that this ſcepticiſm is inlaid in it, and reared along with it; and, therefore, that we muſt lay it open to the foundation, and examine the materials, before we can expect to raiſe any ſolid and uſeful fabric of knowledge on this ſubject.

SECT.

SECT. VIII.

We ought not to deſpair of a better.

BUT is this to be deſpaired of, becauſe DES CARTES and his followers have failed? By no means. This puſillanimity would be injurious to ourſelves, and injurious to truth. Uſeful diſcoveries are ſometimes indeed the effect of ſuperior genius, but more frequently they are the birth of time and of accidents. A traveller of good judgment may miſtake his way, and be unawares led into a wrong track; and while the road is fair before him, he may go on without ſuſpicion and be followed by others; but when it ends in a coal-pit, it requires no great judgment to know that he hath gone wrong, nor perhaps to find out what miſled him.

In the mean time, the unproſperous ſtate of this part of philoſophy hath produced an effect, ſomewhat diſcouraging indeed to any attempt of this nature, but an effect which might be expected, and which time only and better ſucceſs can remedy. Senſible men, who never will be ſceptics in matters of common life, are apt to treat with ſovereign contempt

tempt every thing that hath been ſaid, or is to be ſaid, upon this ſubject.—It is metaphyſic, ſay they: Who minds it? Let ſcholaſtic ſophiſters entangle themſelves in their own cobwebs; I am reſolved to take my own exiſtence, and the exiſtence of other things, upon truſt; and to believe that ſnow is cold, and honey ſweet, whatever they may ſay to the contrary. He muſt either be a fool, or want to make a fool of me, that would reaſon me out of my reaſon and ſenſes.

I confeſs I know not what a ſceptic can anſwer to this, nor by what good argument he can plead even for a hearing; for either his reaſoning is ſophiſtry, and ſo deſerves contempt; or there is no truth in the human faculties, and then why ſhould we reaſon?

If therefore a man find himſelf entangled in theſe metaphyſical toils, and can find no other way to eſcape, let him bravely cut the knot which he cannot looſe, curſe metaphyſic, and diſſuade every man from meddling with it. For if I have been led into bogs and quagmires by following an *ignis fatuus*, what can I do better, than to warn others to beware of it? If Philoſophy contradicts herſelf, befools her votaries, and deprives them of every object worthy to be purſued or enjoyed, let

let her be ſent back to the infernal regions from which ſhe muſt have had her original.

But is it abſolutely certain that this fair lady is of the party? Is it not poſſible ſhe may have been miſrepreſented? Have not men of genius in former ages often made their own dreams to paſs for her oracles? Ought ſhe then to be condemned without any further hearing? This would be unreaſonable. I have found her in all other matters an agreeable companion, a faithful counſellor, a friend to Common Senſe, and to the happineſs of mankind. This juſtly entitles her to my correſpondence and confidence, till I find infallible proofs of her infidelity.

CHAP. II.

OF SMELLING.

SECT. I.

The order of proceeding. Of the medium and organ of ſmell.

IT is ſo difficult to unravel the operations of the human underſtanding, and to reduce them to their firſt principles, that we cannot expect to ſucceed in the attempt, but by beginning with the ſimpleſt, and proceeding by very cautious ſteps to the more complex. The five external ſenſes may, for this reaſon, claim to be firſt conſidered in an analyſis of the human faculties. And the ſame reaſon ought to determine us to make a choice even among the ſenſes, and to give the precedence, not to the nobleſt, or moſt uſeful, but to the ſimpleſt, and that whoſe objects are leaſt in danger of being miſtaken for other things.

In this view, an analyſis of our ſenſations may be carried on, perhaps with moſt eaſe and

and diſtinctneſs, by taking them in this order: Smelling, Taſting, Hearing, Touch, and, laſt of all, Seeing.

Natural philoſophy informs us, that all animal and vegetable bodies, and probably all or moſt other bodies, while expoſed to the air, are continually ſending forth effluvia of vaſt ſubtilty, not only in their ſtate of life and growth, but in the ſtates of fermentation and putrefaction. Theſe volatile particles do probably repel each other, and ſo ſcatter themſelves in the air, until they meet with other bodies to which they have ſome chemical affinity, and with which they unite, and form new concretes. All the ſmell of plants, and of other bodies, is cauſed by theſe volatile parts, and is ſmelled wherever they are ſcattered in the air: And the acuteneſs of ſmell in ſome animals, ſhews us, that theſe effluvia ſpread far, and muſt be inconceivably ſubtile.

Whether, as ſome chemiſts conceive, every ſpecies of bodies hath a *ſpiritus rector*, a kind of ſoul, which cauſes the ſmell, and all the ſpecific virtues of that body, and which, being extremely volatile, flies about in the air in queſt of a proper receptacle, I do not inquire. This, like moſt other theories, is

perhaps rather the product of imagination than of juſt induction. But that all bodies are ſmelled by means of effluvia which they emit, and which are drawn into the noſtrils along with the air, there is no reaſon to doubt. So that there is manifeſt appearance of deſign in placing the organ of ſmell in the inſide of that canal, through which the air is continually paſſing in inſpiration and expiration.

Anatomy informs us, that the *membrana pituitaria*, and the olfactory nerves, which are diſtributed to the villous parts of this membrane, are the organs deſtined by the wiſdom of nature to this ſenſe; ſo that when a body emits no effluvia, or when they do not enter into the noſe, or when the pituitary membrane or olfactory nerves are rendered unfit to perform their office, it cannot be ſmelled.

Yet notwithſtanding this, it is evident that neither the organ of ſmell, nor the medium, nor any motions we can conceive excited in the membrane above mentioned, or in the nerve or animal ſpirits, do in the leaſt reſemble the ſenſation of ſmelling; nor could that ſenſation of itſelf ever have led us to think of nerves, animal ſpirits, or effluvia.

SECT.

SECT. II.

The ſenſation conſidered abſtractly.

HAVING premiſed theſe things, with regard to the medium and organ of this ſenſe, let us now attend carefully to what the mind is conſcious of when we ſmell a roſe or a lily; and ſince our language affords no other name for this ſenſation, we ſhall call it a *ſmell* or *odour*, carefully excluding from the meaning of thoſe names every thing but the ſenſation itſelf, at leaſt till we have examined it.

Suppoſe a perſon who never had this ſenſe before, to receive it all at once, and to ſmell a roſe; can he perceive any ſimilitude or agreement between the ſmell and the roſe? or indeed between it and any other object whatſoever? Certainly he cannot. He finds himſelf affected in a new way, he knows not why or from what cauſe. Like a man that feels ſome pain or pleaſure formerly unknown to him, he is conſcious that he is not the cauſe of it himſelf; but cannot, from the nature of the thing, determine whether it is cauſed by body

or ſpirit, by ſomething near, or by ſomething at a diſtance. It has no ſimilitude to any thing elſe, ſo as to admit of a compariſon; and therefore he can conclude nothing from it, unleſs perhaps that there muſt be ſome unknown cauſe of it.

It is evidently ridiculous, to aſcribe to it figure, colour, extenſion, or any other quality of bodies. He cannot give it a place, any more than he can give a place to melancholy or joy: nor can he conceive it to have any exiſtence, but when it is ſmelled. So that it appears to be a ſimple and original affection or feeling of the mind, altogether inexplicable and unaccountable. It is indeed impoſſible that it can be in any body: It is a ſenſation; and a ſenſation can only be in a ſentient thing.

The various odours have each their different degrees of ſtrength or weakneſs. Moſt of them are agreeable or diſagreeable; and frequently thoſe that are agreeable when weak, are diſagreeable when ſtronger. When we compare different ſmells together, we can perceive very few reſemblances or contrarieties, or indeed relations of any kind between them. They are all ſo ſimple in themſelves, and ſo different from each other, that it is hardly

hardly poſſible to divide them into *genera* and *ſpecies*. Moſt of the names we give them are particular; as the ſmell of a *roſe*, of a *jeſſamine*, and the like. Yet there are ſome general names; as *ſweet*, *ſtinking*, *muſty*, *putrid*, *cadaverous*, *aromatic*. Some of them ſeem to refreſh and animate the mind, others to deaden and depreſs it.

SECT. III.

Senſation and remembrance, natural principles of belief.

SO far we have conſidered this ſenſation abſtractly. Let us next compare it with other things to which it bears ſome relation. And firſt I ſhall compare this ſenſation with the remembrance, and the imagination of it.

I can think of the ſmell of a roſe when I do not ſmell it; and it is poſſible that when I think of it, there is neither roſe nor ſmell any where exiſting. But when I ſmell it, I am neceſſarily determined to believe that the ſenſation really exiſts. This is common to all ſenſations, that as they cannot exiſt but in

being perceived; ſo they cannot be perceived, but they muſt exiſt. I could as eaſily doubt of my own exiſtence, as of the exiſtence of my ſenſations. Even thoſe profound philoſophers who have endeavoured to diſprove their own exiſtence, have yet left their ſenſations to ſtand upon their own bottom, ſtript of a ſubject, rather than call in queſtion the reality of their exiſtence.

Here then a ſenſation, a ſmell for inſtance, may be preſented to the mind three different ways: it may be ſmelled, it may be remembered, it may be imagined or thought of. In the firſt caſe, it is neceſſarily accompanied with a belief of its preſent exiſtence; in the ſecond, it is neceſſarily accompanied with a belief of its paſt exiſtence; and in the laſt, it is not accompanied with belief at all, but is what the logicians call *a ſimple apprehenſion.*

Why ſenſation ſhould compel our belief of the preſent exiſtence of the thing, memory a belief of its paſt exiſtence, and imagination no belief at all, I believe no philoſopher can give a ſhadow of reaſon, but that ſuch is the nature of theſe operations: They are all ſimple and original, and therefore inexplicable acts of the mind.

Suppoſe

Suppoſe that once, and only once, I ſmelled a tuberoſe in a certain room where it grew in a pot, and gave a very grateful perfume. Next day I relate what I ſaw and ſmelled. When I attend as carefully as I can to what paſſes in my mind in this caſe, it appears evident, that the very thing I ſaw yeſterday, and the fragrance I ſmelled, are now the immediate objects of my mind when I remember it. Further, I can imagine this pot and flower tranſported to the room where I now ſit, and yielding the ſame perfume. Here likewiſe it appears, that the individual thing which I ſaw and ſmelled, is the object of my imagination.

Philoſophers indeed tell me, that the immediate object of my memory and imagination in this caſe, is not the paſt ſenſation, but an idea of it, an image, phantaſm, or ſpecies of the odour I ſmelled: that this idea now exiſts in my mind, or in my ſenſorium; and the mind contemplating this preſent idea, finds it a repreſentation of what is paſt, or of what may exiſt; and accordingly calls it memory, or imagination. This is the doctrine of the ideal philoſophy; which we ſhall not now examine, that we may not interrupt the thread of the preſent inveſtigation. Upon

on the ſtricteſt attention, memory appears to me to have things that are paſt, and not preſent ideas, for its object. We ſhall afterwards examine this ſyſtem of ideas, and endeavour to make it appear, that no ſolid proof has ever been advanced of the exiſtence of ideas; that they are a mere fiction and hypotheſis, contrived to ſolve the phenomena of the human underſtanding; that they do not at all anſwer this end; and that this hypotheſis of ideas or images of things in the mind, or in the ſenſorium, is the parent of thoſe many paradoxes ſo ſhocking to common ſenſe, and of that ſcepticiſm, which diſgrace our philoſophy of the mind, and have brought upon it the ridicule and contempt of ſenſible men.

In the mean time, I beg leave to think with the vulgar, that when I remember the ſmell of the tuberoſe, that very ſenſation which I had yeſterday, and which has now no more any exiſtence, is the immediate object of my memory; and when I imagine it preſent, the ſenſation itſelf, and not any idea of it, is the object of my imagination. But though the object of my ſenſation, memory, and imagination, be in this caſe the ſame, yet theſe acts or operations of the mind are as different,

different, and as eaſily diſtinguiſhable, as ſmell, taſte, and ſound. I am conſcious of a difference in kind between ſenſation and memory, and between both and imagination. I find this alſo, that the ſenſation compels my belief of the preſent exiſtence of the ſmell, and memory my belief of its paſt exiſtence. There is a ſmell, is the immediate teſtimony of ſenſe; there was a ſmell, is the immediate teſtimony of memory. If you aſk me, why I believe that the ſmell exiſts? I can give no other reaſon, nor ſhall ever be able to give any other, than that I ſmell it. If you aſk, why I believe that it exiſted yeſterday? I can give no other reaſon but that I remember it.

Senſation and memory therefore are ſimple, original, and perfectly diſtinct operations of the mind, and both of them are original principles of belief. Imagination is diſtinct from both, but is no principle of belief. Senſation implies the preſent exiſtence of its object; memory its paſt exiſtence; but imagination views its object naked, and without any belief of its exiſtence or non-exiſtence, and is therefore what the ſchools call *ſimple apprehenſion.*

SECT.

SECT. IV.

Judgment and belief in ſome caſes precede ſimple apprehenſion.

BUT here again the ideal ſyſtem comes in our way; it teaches us, that the firſt operation of the mind about its ideas, is ſimple apprehenſion; that is, the bare conception of a thing without any belief about it; and that after we have got ſimple apprehenſions, by comparing them together, we perceive agreements or diſagreements between them; and that this perception of the agreement or diſagreement of ideas, is all that we call belief, judgment, or knowledge. Now, this appears to me to be all fiction, without any foundation in nature: for it is acknowledged by all, that ſenſation muſt go before memory and imagination; and hence it neceſſarily follows, that apprehenſion accompanied with belief and knowledge, muſt go before ſimple apprehenſion, at leaſt in the matters we are now ſpeaking of. So that here, inſtead of ſaying, that the belief or knowledge is got by putting together and comparing the ſimple apprehenſions, we ought rather to ſay, that the ſimple apprehenſion

apprehenſion is performed by reſolving and analyſing a natural and original judgment. And it is with the operations of the mind, in this caſe, as with natural bodies, which are indeed compounded of ſimple principles or elements. Nature does not exhibit theſe elements ſeparate, to be compounded by us; ſhe exhibits them mixed and compounded in concrete bodies, and it is only by art and chemical analyſis that they can be ſeparated.

SECT. V.

Two theories of the nature of belief refuted. Concluſions from what hath been ſaid.

BUT what is this belief or knowledge which accompanies ſenſation and memory? Every man knows what it is, but no man can define it. Does any man pretend to define ſenſation, or to define conſciouſneſs? It is happy indeed that no man does. And if no philoſopher had attempted to define and explain belief, ſome paradoxes in philoſophy, more incredible than ever were brought forth by the moſt abject ſuperſtition, or the moſt frantic

frantic enthuſiaſm, had never ſeen the light. Of this kind ſurely is that modern diſcovery of the ideal philoſophy, that ſenſation, memory, belief and imagination, when they have the ſame object, are only different degrees of ſtrength and vivacity in the idea. Suppoſe the idea to be that of a future ſtate after death; one man believes it firmly; this means no more than that he hath a ſtrong and lively idea of it: Another neither believes nor diſbelieves; that is, he has a weak and faint idea. Suppoſe now a third perſon believes firmly that there is no ſuch thing; I am at a loſs to know whether his idea be faint or lively: If it is faint, then there may be a firm belief where the idea is faint; if the idea is lively, then the belief of a future ſtate and the belief of no future ſtate muſt be one and the ſame. The ſame arguments that are uſed to prove that belief implies only a ſtronger idea of the object than ſimple apprehenſion, might as well be uſed to prove that love implies only a ſtronger idea of the object than indifference. And then what ſhall we ſay of hatred, which muſt upon this hypotheſis be a degree of love, or a degree of indifference? If it ſhould be ſaid, that in love there is ſomething more than an idea, to wit, an affection of the mind;

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may it not be ſaid with equal reaſon, that in belief there is ſomething more than an idea, to wit, an aſſent or perſuaſion of the mind?

But perhaps it may be thought as ridiculous to argue againſt this ſtrange opinion, as to maintain it. Indeed, if a man ſhould maintain, that a circle, a ſquare, and a triangle, differ only in magnitude, and not in figure, I believe he would find nobody diſpoſed either to believe him or to argue againſt him; and yet I do not think it leſs ſhocking to common ſenſe, to maintain, that ſenſation, memory, and imagination, differ only in degree, and not in kind. I know it is ſaid, that in a delirium, or in dreaming, men are apt to miſtake one for the other. But does it follow from this, that men who are neither dreaming, nor in a delirium, cannot diſtinguiſh them? But how does a man know, that he is not in a delirium? I cannot tell: neither can I tell how a man knows that he exiſts: But if any man ſeriouſly doubts whether he is in a delirium, I think it highly probable that he is, and that it is time to ſeek for a cure, which I am perſuaded he will not find in the whole ſyſtem of logic.

I mentioned before, LOCKE's notion of belief or knowledge: he holds that it conſiſts in a perception

perception of the agreement or diſagreement of ideas; and this he values himſelf upon as a very important diſcovery.

We ſhall have occaſion afterwards to examine more particularly this grand principle of LOCKE's philoſophy, and to ſhew that it is one of the main pillars of modern ſcepticiſm, although he had no intention to make that uſe of it. At preſent let us only conſider how it agrees with the inſtances of belief now under conſideration; and whether it gives any light to them. I believe that the ſenſation I have, exiſts; and that the ſenſation I remember, does not now exiſt, but did exiſt yeſterday. Here, according to LOCKE's ſyſtem, I compare the idea of a ſenſation with the ideas of paſt and preſent exiſtence: at one time that this idea agrees with that of preſent exiſtence, but diſagrees with that of paſt exiſtence; but at another time it agrees with the idea of paſt exiſtence, and diſagrees with that of preſent exiſtence. Truly theſe ideas ſeem to be very capricious in their agreements and diſagreements. Beſides, I cannot for my heart conceive what is meant by either. I ſay a ſenſation exiſts, and I think I underſtand clearly what I mean. But you want to make the thing clearer, and for that end tell me, that there

there is an agreement between the idea of that ſenſation and the idea of exiſtence. To ſpeak freely, this conveys to me no light, but darkneſs; I can conceive no otherwiſe of it, than as an odd and obſcure circumlocution. I conclude, then, that the belief which accompanies ſenſation and memory, is a ſimple act of the mind, which cannot be defined. It is in this reſpect like ſeeing and hearing, which can never be ſo defined as to be underſtood by thoſe who have not theſe faculties: and to ſuch as have them, no definition can make theſe operations more clear than they are already. In like manner, every man that has any belief, and he muſt be a curioſity that has none, knows perfectly what belief is, but can never define or explain it. I conclude alſo, that ſenſation, memory, and imagination, even where they have the ſame object, are operations of a quite different nature, and perfectly diſtinguiſhable by thoſe who are ſound and ſober. A man that is in danger of confounding them, is indeed to be pitied; but whatever relief he may find from another art, he can find none from logic or metaphyſic. I conclude further, that it is no leſs a part of the human conſtitution, to believe the preſent exiſtence of our ſenſations, and to believe the

paſt exiſtence of what we remember, than it is to believe that twice two make four. The evidence of ſenſe, the evidence of memory, and the evidence of the neceſſary relations of things, are all diſtinct and original kinds of evidence, equally grounded on our conſtitution: none of them depends upon, or can be reſolved into another. To reaſon againſt any of theſe kinds of evidence, is abſurd; nay to reaſon for them, is abſurd. They are firſt principles; and ſuch fall not within the province of Reaſon, but of Common Senſe.

SECT. VI.

Apology for metaphyſical abſurdities. Senſation without a ſentient, a conſequence of the theory of ideas. Conſequences of this ſtrange opinion.

HAVING conſidered the relation which the ſenſation of ſmelling bears to the remembrance and imagination of it, I proceed to conſider, what relation it bears to a mind, or ſentient principle. It is certain, no man can conceive or believe ſmelling to exiſt of itſelf,

ſelf, without a mind, or ſomething that has the power of ſmelling, of which it is called a ſenſation, an operation or feeling. Yet if any man ſhould demand a proof, that ſenſation cannot be without a mind or ſentient being, I confeſs that I can give none; and that to pretend to prove it, ſeems to me almoſt as abſurd as to deny it.

This might have been ſaid without any apology before the *Treatiſe of Human Nature* appeared in the world. For till that time, no man, as far as I know, ever thought either of calling in queſtion that principle, or of giving a reaſon for his belief of it. Whether thinking beings were of an ethereal or igneous nature, whether material or immaterial, was variouſly diſputed; but that thinking is an operation of ſome kind of being or other, was always taken for granted, as a principle that could not poſſibly admit of doubt.

However, ſince the author above mentioned, who is undoubtedly one of the moſt acute metaphyſicians that this or any age hath produced, hath treated it as a vulgar prejudice, and maintained, that the mind is only a ſucceſſion of ideas and impreſſions without any ſubject; his opinion, however contrary to the common apprehenſions of mankind, deſerves

reſpect. I beg therefore, once for all, that no offence may be taken at charging this or other metaphyſical notions with abſurdity, or with being contrary to the common ſenſe of mankind. No diſparagement is meant to the underſtandings of the authors or maintainers of ſuch opinions. Indeed they, commonly proceed not from defect of underſtanding, but from an exceſs of refinement: the reaſoning that leads to them, often gives new light to the ſubject, and ſhews real genius and deep penetration in the author; and the premiſes do more than atone for the concluſion.

If there are certain principles, as I think there are, which the conſtitution of our nature leads us to believe, and which we are under a neceſſity to take for granted in the common concerns of life, without being able to give a reaſon for them; theſe are what we call the principles of common ſenſe; and what is manifeſtly contrary to them, is what we call abſurd.

Indeed, if it is true, and to be received as a principle of philoſophy, That ſenſation and thought may be without a thinking being; it muſt be acknowledged to be the moſt wonderful diſcovery that this or any other age hath produced. The received doctrine of ideas is

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the principle from which it is deduced, and of which indeed it ſeems to be a juſt and natural conſequence. And it is probable, that it would not have been ſo late a diſcovery, but that it is ſo ſhocking and repugnant to the common apprehenſions of mankind, that it required an uncommon degree of philoſophical intrepidity to uſher it into the world. It is a fundamental principle of the ideal ſyſtem, That every object of thought muſt be an impreſſion, or an idea, that is, a faint copy of ſome preceding impreſſion. This is a principle ſo commonly received, that the author above mentioned, although his whole ſyſtem is built upon it, never offers the leaſt proof of it. It is upon this principle, as a fixed point, that he erects his metaphyſical engines, to overturn heaven and earth, body and ſpirit. And indeed, in my apprehenſion, it is altogether ſufficient for the purpoſe. For if impreſſions and ideas are the only objects of thought, then heaven and earth, and body and ſpirit, and every thing you pleaſe, muſt ſignify only impreſſions and ideas, or they muſt be words without any meaning. It ſeems, therefore, that this notion, however ſtrange, is cloſely connected with the received doctrine of ideas, and we muſt either admit

the concluſion, or call in queſtion the premiſes.

Ideas ſeem to have ſomething in their nature unfriendly to other exiſtences. They were firſt introduced into philoſophy, in the humble character of images or repreſentatives of things; and in this character they ſeemed not only to be inoffenſive, but to ſerve admirably well for explaining the operation of the human underſtanding. But ſince men began to reaſon clearly and diſtinctly about them, they have by degrees ſupplanted their conſtituents, and undermined the exiſtence of every thing but themſelves. Firſt, they diſcarded all ſecondary qualities of bodies; and it was found out by their means, that fire is not hot, nor ſnow cold, nor honey ſweet; and, in a word, that heat and cold, ſound, colour, taſte, and ſmell, are nothing but ideas or impreſſions. Biſhop BERKELEY advanced them a ſtep higher, and found out, by juſt reaſoning, from the ſame principles, that extenſion, ſolidity, ſpace, figure, and body, are ideas, and that there is nothing in nature but ideas and ſpirits. But the triumph of ideas was completed by the *Treatiſe of Human Nature*, which diſcards ſpirits alſo, and leaves ideas and impreſſions as the ſole exiſtences in the univerſe.

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What if at laſt, having nothing elſe to contend with, they ſhould fall foul of one another, and leave no exiſtence in nature at all? This would ſurely bring philoſophy into danger; for what ſhould we have left to talk or to diſpute about?

However, hitherto theſe philoſophers acknowledge the exiſtence of impreſſions and ideas; they acknowledge certain laws of attraction, or rules of precedence, according to which ideas and impreſſions range themſelves in various forms, and ſucceed one another: but that they ſhould belong to a mind, as its proper goods and chattels, this they have found to be a vulgar error. Theſe ideas are as free and independent as the birds of the air, or as EPICURUS's atoms when they purſued their journey in the vaſt inane. Shall we conceive them like the films of things in the Epicurean ſyſtem?

Principio hoc dico, rerum ſimulacra vagari,
Multa modis multis, in cunctas undique parteis
Tenuia, quæ facile inter ſe junguntur in auris,
Obvia cum veniunt.

LUCR.

Or do they rather reſemble ARISTOTLE's intelligible ſpecies after they are ſhot forth from

the object, and before they have yet ſtruck upon the paſſive intellect? But why ſhould we ſeek to compare them with any thing, ſince there is nothing in nature but themſelves? They make the whole furniture of the univerſe; ſtarting into exiſtence, or out of it, without any cauſe; combining into parcels, which the vulgar call *minds;* and ſucceeding one another by fixed laws, without time, place, or author of thoſe laws.

Yet, after all, theſe ſelf-exiſtent and independent ideas look pitifully naked and deſtitute, when left thus alone in the univerſe, and ſeem, upon the whole, to be in a worſe condition than they were before. DES CARTES, MALEBRANCHE, and LOCKE, as they made much uſe of ideas, treated them handſomely, and provided them in decent accommodation; lodging them either in the pineal gland, or in the pure intellect, or even in the divine mind. They moreover clothed them with a commiſſion, and made them repreſentatives of things, which gave them ſome dignity and character. But the *Treatiſe of Human Nature*, though no leſs indebted to them, ſeems to have made but a bad return, by beſtowing upon them this independent exiſtence; ſince thereby they are turned out of houſe and home, and ſet adrift in

in the world, without friend or connexion, without a rag to cover their nakedneſs; and who knows but the whole ſyſtem of ideas may periſh by the indiſcreet zeal of their friends to exalt them?

However this may be, it is certainly a moſt amazing diſcovery that thought and ideas may be without any thinking being:—a diſcovery big with conſequences which cannot eaſily be traced by thoſe deluded mortals who think and reaſon in the common track. We were always apt to imagine, that thought ſuppoſed a thinker, and love a lover, and treaſon a traitor: but this, it ſeems, was all a miſtake; and it is found out, that there may be treaſon without a traitor, and love without a lover, laws without a legiſlator, and puniſhment without a ſufferer, ſucceſſion without time, and motion without any thing moved, or ſpace in which it may move: or if, in theſe caſes, ideas are the lover, the ſufferer, the traitor, it were to be wiſhed that the author of this diſcovery had further condeſcended to acquaint us, whether ideas can converſe together, and be under obligations of duty or gratitude to each other; whether they can make promiſes, and enter into leagues and covenants, and fulfil or break them, and be puniſhed for the breach? If one

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ſet of ideas makes a covenant, another breaks it, and a third is puniſhed for it, there is reaſon to think that juſtice is no natural virtue in this ſyſtem.

It ſeemed very natural to think, that the *Treatiſe of Human Nature* required an Author, and a very ingenious one too; but now we learn, that it is only a ſet of ideas which came together, and arranged themſelves by certain aſſociations and attractions.

After all, this curious ſyſtem appears not to be fitted to the preſent ſtate of human nature. How far it may ſuit ſome choice ſpirits, who are refined from the dregs of common ſenſe, I cannot ſay. It is acknowledged, I think, that even theſe can enter into this ſyſtem only in their moſt ſpeculative hours, when they ſoar ſo high in purſuit of thoſe ſelf-exiſtent ideas, as to loſe ſight of all other things. But when they condeſcend to mingle again with the human race, and to converſe with a friend, a companion, or a fellow citizen, the ideal ſyſtem vaniſhes; common ſenſe, like an irreſiſtible torrent, carries them along; and, in ſpite of all their reaſoning and philoſophy, they believe their own exiſtence, and the exiſtence of other things.

Indeed,

Indeed, it is happy they do ſo; for if they ſhould carry their cloſet belief into the world, the reſt of mankind would conſider them as diſeaſed, and ſend them to an infirmary. Therefore, as PLATO required certain previous qualifications of thoſe who entered his ſchool, I think it would be prudent for the doctors of this ideal philoſophy to do the ſame, and to refuſe admittance to every man who is ſo weak, as to imagine that he ought to have the ſame belief in ſolitude and in company, or that his principles ought to have any influence upon his practice: for this philoſophy is like a hobby-horſe, which a man in bad health may ride in his cloſet, without hurting his reputation; but if he ſhould take him abroad with him to church, or to the exchange, or to the play-houſe, his heir would immediately call a jury, and ſeize his eſtate.

SECT.

SECT. VII.

The conception and belief of a ſentient being or mind, is ſuggeſted by our conſtitution. The notion of relations not always got by comparing the related ideas.

LEAVING this philoſophy, therefore, to thoſe who have occaſion for it, and can uſe it diſcreetly as a chamber-exerciſe, we may ſtill inquire, how the reſt of mankind, and even the adepts themſelves, except in ſome ſolitary moments, have got ſo ſtrong and irreſiſtible a belief, that thought muſt have a ſubject, and be the act of ſome thinking being: how every man believes himſelf to be ſomething diſtinct from his ideas and impreſſions; ſomething which continues the ſame identical ſelf when all his ideas and impreſſions are changed. It is impoſſible to trace the origin of this opinion in hiſtory: for all languages have it interwoven in their original conſtruction. All nations have always believed it. The conſtitution of all laws and governments, as well as the common tranſactions of life, ſuppoſe it.

It

It is no leſs impoſſible for any man to recollect when he himſelf came by this notion; for, as far back as we can remember, we were already in poſſeſſion of it, and as fully perſuaded of our own exiſtence, and the exiſtence of other things, as that one and one make two. It ſeems, therefore, that this opinion preceded all reaſoning, and experience, and inſtruction; and this is the more probable, becauſe we could not get it by any of theſe means. It appears then to be an undeniable fact, that from thought or ſenſation, all mankind, conſtantly and invariably, from the firſt dawning of reflection, do infer a power or faculty of thinking, and a permanent being or mind to which that faculty belongs; and that we as invariably aſcribe all the various kinds of ſenſation and thought we are conſcious of, to one individual mind or ſelf.

But by what rules of logic we make theſe inferences, it is impoſſible to ſhow; nay, it is impoſſible to ſhow how our ſenſations and thoughts can give us the very notion and conception either of a mind or of a faculty. The faculty of ſmelling is ſomething very different from the actual ſenſation of ſmelling; for the faculty may remain when we have no ſenſation. And the mind is no leſs different from the

the faculty; for it continues the ſame individual being when that faculty is loſt. Yet this ſenſation ſuggeſts to us both a faculty and a mind; and not only ſuggeſts the notion of them, but creates a belief of their exiſtence; although it is impoſſible to diſcover, by reaſon, any tie or connection between one and the other.

What ſhall we ſay then? Either thoſe inferences which we draw from our ſenſations, namely, the exiſtence of a mind, and of powers or faculties belonging to it, are prejudices of philoſophy or education, mere fictions of the mind, which a wiſe man ſhould throw off as he does the belief of fairies; or they are judgments of nature, judgments not got by comparing ideas, and perceiving agreements and diſagreements, but immediately inſpired by our conſtitution.

If this laſt is the caſe, as I apprehend it is, it will be impoſſible to ſhake off thoſe opinions, and we muſt yield to them at laſt, though we ſtruggle hard to get rid of them. And if we could, by a determined obſtinacy, ſhake off the principles of our nature, this is not to act the philoſopher, but the fool or the madman. It is incumbent upon thoſe who think that theſe are not natural principles, to ſhow,

ſhow, in the firſt place, how we can otherwiſe get the notion of a mind and its faculties; and then to ſhow, how we come to deceive ourſelves into the opinion that ſenſation cannot be without a ſentient being.

It is the received doctrine of philoſophers, that our notions of relations can only be got by comparing the related ideas: but, in the preſent caſe, there ſeems to be an inſtance to the contrary. It is not by having firſt the notions of mind and ſenſation, and then comparing them together, that we perceive the one to have the relation of a ſubject or ſubſtratum, and the other that of an act or operation: on the contrary, one of the related things, to wit, ſenſation, ſuggeſts to us both the correlate and the relation.

I beg leave to make uſe of the word *ſuggeſtion*, becauſe I know not one more proper, to expreſs a power of the mind, which ſeems entirely to have eſcaped the notice of philoſophers, and to which we owe many of our ſimple notions which are neither impreſſions nor ideas, as well as many original principles of belief. I ſhall endeavour to illuſtrate, by an example, what I underſtand by this word. We all know, that a certain kind of ſound ſuggeſts immediately to the mind, a coach paſſing

paſſing in the ſtreet; and not only produces the imagination, but the belief, that a coach is paſſing. Yet there is here no comparing of ideas, no perception of agreements or diſagreements, to produce this belief; nor is there the leaſt ſimilitude between the ſound we hear, and the coach we imagine and believe to be paſſing.

It is true that this ſuggeſtion s not natural and orginal; it is the reſult of experience and habit. But I think it appears, from what hath been ſaid, that there are natural ſuggeſtions; particularly, that ſenſation ſuggeſts the notion of preſent exiſtence, and the belief that what we perceive or feel, does now exiſt; that memory ſuggeſts the notion of paſt exiſtence, and the belief that what we remember did exiſt in time paſt; and that our ſenſations and thoughts do alſo ſuggeſt the notion of a mind, and the belief of its exiſtence, and of its relation to our thoughts. By a like natural p.inciple it is, that a beginning of exiſtence, or any change in nature, ſuggeſts to us the notion of a cauſe, and compels our belief of its exiſtence. And in like manner, as ſhall be ſhewn when we come to the ſenſe of touch, certain ſenſations of touch, by the conſtitution of our nature, ſuggeſt to us extenſion, ſolidity,

lidity, and motion, which are nowiſe like to ſenſations, although they have been hitherto confounded with them.

SECT. VIII.

There is a quality or virtue in bodies, which we call their ſmell. How this is connected in the imagination with the ſenſation.

WE have conſidered ſmell as ſignifying a ſenſation, feeling, or impreſſion upon the mind; and in this ſenſe, it can only be in a mind, or ſentient being: but it is evident, that mankind give the name of *ſmell* much more frequently to ſomething which they conceive to be external, and to be a quality of body: they underſtand ſomething by it which does not at all infer a mind; and have not the leaſt difficulty in conceiving the air perfumed with aromatic odours in the deſarts of Arabia, or in ſome uninhabited iſland, where the human foot never trod. Every ſenſible day-labourer hath as clear a notion of this, and as full a conviction of the poſſibility

of it, as he hath of his own exiſtence; and can no more doubt of the one than of the other.

Suppoſe that ſuch a man meets with a modern philoſopher, and wants to be informed, what ſmell in plants is. The philoſopher tells him, that there is no ſmell in plants, nor in any thing, but in the mind; that it is impoſſible there can be ſmell but in a mind; and that all this hath been demonſtrated by modern philoſophy. The plain man will, no doubt, be apt to think him merry: but if he finds that he is ſerious, his next concluſion will be, that he is mad; or that philoſophy, like magic, puts men into a new world, and gives them different faculties from common men. And thus philoſophy and common ſenſe are ſet at variance. But who is to blame for it? In my opinion the philoſopher is to blame. For if he means by ſmell what the reſt of mankind moſt commonly mean, he is certainly mad. But if he puts a different meaning upon the word, without obſerving it himſelf, or giving warning to others, he abuſes language, and diſgraces philoſophy, without doing any ſervice to truth: as if a man ſhould exchange the meaning of the words *daughter* and *cow*, and then endeavour to prove

prove to his plain neighbour, that his cow is his daughter, and his daughter his cow.

I believe there is not much more wiſdom in many of thoſe paradoxes of the ideal philoſophy, which to plain ſenſible men appear to be palpable abſurdities, but with the adepts paſs for profound diſcoveries. I reſolve, for my own part, always to pay a great regard to the dictates of common ſenſe, and not to depart from them without abſolute neceſſity; and therefore I am apt to think, that there is really ſomething in the roſe or lily, which is by the vulgar called *ſmell*, and which continues to exiſt when it is not ſmelled: and ſhall proceed to inquire what this is; how we come by the notion of it; and what relation this quality or virtue of ſmell hath to the ſenſation, which we have been obliged to call by the ſame name, for want of another.

Let us therefore ſuppoſe, as before, a perſon beginning to exerciſe the ſenſe of ſmelling: a little experience will diſcover to him, that the noſe is the organ of this ſenſe, and that the air, or ſomething in the air, is a medium of it. And finding by further experience, that when a roſe is near, he has a certain ſenſation; when it is removed, the ſenſation is gone; he finds a connection in nature

betwixt the roſe and this ſenſation. The roſe is conſidered as a cauſe, occaſion, or antecedent, of the ſenſation; the ſenſation as an effect or conſequent of the preſence of the roſe: they are aſſociated in the mind, and conſtantly found conjoined in the imagination.

But here it deſerves our notice, that although the ſenſation may ſeem more cloſely related to the mind its ſubject, or to the noſe its organ; yet neither of theſe connections operate ſo powerfully upon the imagination, as its connection with the roſe its concomitant. The reaſon of this ſeems to be, that its connection with the mind is more general, and noway diſtinguiſheth it from other ſmells, or even from taſtes, ſounds, and other kinds of ſenſations. The relation it hath to the organ, is likewiſe general, and doth not diſtinguiſh it from other ſmells: but the connection it hath with the roſe is ſpecial, and conſtant; by which means they become almoſt inſeparable in the imagination, in like manner as thunder and lightning, freezing and cold.

SECT.

SECT. IX.

That there is a principle in human nature, from which the notion of this, as well as all other natural virtues or cauſes, is derived.

IN order to illuſtrate further how we come to conceive a quality or virtue in the roſe which we call *ſmell*, and what this ſmell is, it is proper to obſerve, that the mind begins very early to thirſt after principles, which may direct it in the exertion of its powers. The ſmell of a roſe is a certain affection or feeling of the mind; and as it is not conſtant, but comes and goes, we want to know when and where we may expect it, and are uneaſy till we find ſomething, which being preſent, brings this feeling along with it, and being removed, removes it. This, when found, we call the cauſe of it; not in a ſtrict and philoſophical ſenſe: as if the feeling were really effected or produced by that cauſe, but in a popular ſenſe: for the mind is ſatisfied, if

there is a conſtant conjunction between them; and ſuch cauſes are in reality nothing elſe but laws of nature. Having found the ſmell thus conſtantly conjoined with the roſe, the mind is at reſt, without inquiring whether this conjunction is owing to a real efficiency or not; that being a philoſophical inquiry, which does not concern human life. But every diſcovery of ſuch a conſtant conjunction is of real importance in life, and makes a ſtrong impreſſion upon the mind.

So ardently do we deſire to find every thing that happens within our obſervation, thus connected with ſomething elſe, as its cauſe or occaſion, that we are apt to fancy connections upon the ſlighteſt grounds: and this weakneſs is moſt remarkable in the ignorant, who know leaſt of the real connections eſtabliſhed in nature. A man meets with an unlucky accident on a certain day of the year; and knowing no other cauſe of his misfortune, he is apt to conceive ſomething unlucky in that day of the calendar; and if he finds the ſame connection hold a ſecond time, is ſtrongly confirmed in his ſuperſtition. I remember, many years ago, a white ox was brought into this country, of ſo enormous a ſize, that people came many miles to ſee him. There

There happened, ſome months after, an uncommon fatality among women in childbearing. Two ſuch uncommon events following one another, gave a ſuſpicion of their connection, and occaſioned a common opinion among the country-people, that the white ox was the cauſe of this fatality.

However ſilly and ridiculous this opinion was, it ſprung from the ſame root in human nature, on which all natural philoſophy grows; namely, an eager deſire to find out connections in things, and a natural, original, and unaccountable propenſity to believe, that the connections which we have obſerved in times paſt, will continue in time to come. Omens, portents, good and bad luck, palmiſtry, aſtrology, all the numerous arts of divination, and of interpreting dreams, falſe hypotheſes and ſyſtems, and true principles in the philoſophy of nature, are all built upon the ſame foundation in the human conſtitution; and are diſtinguiſhed only according as we conclude raſhly from too few inſtances, or cautiouſly from a ſufficient induction.

As it is experience only that diſcovers theſe connections between natural cauſes and their

effects; without inquiring further, we attribute to the cauſe ſome vague and indiſtinct notion of power or virtue to produce the effect. And in many caſes, the purpoſes of life do not make it neceſſary to give diſtinct names to the cauſe and the effect. Whence it happens, that being cloſely connected in the imagination, although very unlike to each other, one name ſerves for both; and, in common diſcourſe, is moſt frequently applied to that which, of the two, is moſt the object of our attention. This occaſions an ambiguity in many words, which having the ſame cauſes in all languages, is common to all, and is apt to be overlooked even by philoſophers. Some inſtances will ſerve both to illuſtrate and confirm what we have ſaid.

Magnetiſm ſignifies both the tendency of the iron towards the magnet, and the power of the magnet to produce that tendency; and if it was aſked, whether it is a quality of the iron or of the magnet? one would perhaps be puzzled at firſt; but a little attention would diſcover, that we conceive a power or virtue in the magnet as the cauſe, and a motion in the iron as the effect; and although theſe are things quite unlike, they are ſo united in the imagination, that we give the common name

of

of *magnetiſm* to both. The ſame thing may be ſaid of *gravitation*, which ſometimes ſignifies the tendency of bodies towards the earth, ſometimes the attractive power of the earth, which we conceive as the cauſe of that tendency. We may obſerve the ſame ambiguity in ſome of Sir Iſaac Newton's definitions; and that even in words of his own making. In three of his definitions, he explains very diſtinctly what he underſtands by the *abſolute* quantity, what by the *accelerative* quantity, and what by the *motive* quantity, of a centripetal force. In the firſt of theſe three definitions, centripetal force is put for the cauſe, which we conceive to be ſome power or virtue in the centre or central body: in the two laſt, the ſame word is put for the effect of this cauſe, in producing velocity, or in producing motion towards that centre.

Heat ſignifies a ſenſation, and *cold* a contrary one. But *heat* likewiſe ſignifies a quality or ſtate of bodies, which hath no contrary, but different degrees. When a man feels the ſame water hot to one hand, and cold to the other, this gives him occaſion to diſtinguiſh between the feeling, and the heat of the body; and although he knows that the ſenſations are contrary, he does not imagine that the

the body can have contrary qualities at the ſame time. And when he finds a different taſte in the ſame body in ſickneſs and in health, he is eaſily convinced, that the quality in the body called *taſte* is the ſame as before, although the ſenſations he has from it are perhaps oppoſite.

The vulgar are commonly charged by philoſophers, with the abſurdity of imagining the ſmell in the roſe to be ſomething like to the ſenſation of ſmelling: but I think, unjuſtly; for they neither give the ſame epithets to both, nor do they reaſon in the ſame manner from them. What is ſmell in the roſe? It is a quality or virtue of the roſe, or of ſomething proceeding from it, which we perceive by the ſenſe of ſmelling; and this is all we know of the matter. But what is ſmelling? It is an act of the mind, but is never imagined to be a quality of the mind. Again, the ſenſation of ſmelling is conceived to infer neceſſarily a mind or ſentient being; but ſmell in the roſe infers no ſuch thing. We ſay, This body ſmells ſweet, that ſtinks; but we do not ſay, This mind ſmells ſweet, and that ſtinks. Therefore, ſmell in the roſe, and the ſenſation which it cauſes, are not conceived, even by the vulgar, to be things of the ſame

ſame kind, although they have the ſame name.

From what hath been ſaid, we may learn, that the ſmell of a roſe ſignifies two things. *Firſt*, A ſenſation, which can have no exiſtence but when it is perceived, and can only be in a ſentient being or mind. *Seconaly*, It ſignifies ſome power, quality, or virtue, in the roſe, or in effluvia proceeding from it, which hath a permanent exiſtence, independent of the mind, and which by the conſtitution of nature, produces the ſenſation in us. By the original conſtitution of our nature, we are both led to believe, that there is a permanent cauſe of the ſenſation, and prompted to ſeek after it; and experience determines us to place it in the roſe. The names of all ſmells, taſtes, ſounds, as well as heat and cold, have a like ambiguity in all languages; but it deſerves our attention, that theſe names are but rarely, in common language, uſed to ſignify the ſenſations; for the moſt part, they ſignify the external qualities which are indicated by the ſenſations. The cauſe of which phenomenon I take to be this: Our ſenſations have very different degrees of ſtrength. Some of them are ſo quick and lively, as to give us a great deal either of pleaſure or of uneaſineſs: When

When this is the caſe, we are compelled to attend to the ſenſation itſelf, and to make it an object of thought and diſcourſe; we give it a name, which ſignifies nothing but the ſenſation; and in this caſe we readily acknowledge, that the thing meant by that name is in the mind only, and not in any thing external. Such are the various kinds of pain, ſickneſs, and the ſenſations of hunger and other appetites. But where the ſenſation is not ſo intereſting as to require to be made an object of thought, our conſtitution leads us to conſider it as a ſign of ſomething external, which hath a conſtant conjunction with it; and having found what it indicates, we give a name to that: the ſenſation, having no proper name, falls in as an acceſſory to the thing ſignified by it, and is confounded under the ſame name. So that the name may indeed be applied to the ſenſation, but moſt properly and commonly is applied to the thing indicated by that ſenſation. The ſenſations of ſmell, taſte, ſound, and colour, are of infinitely more importance as ſigns or indications, than they are upon their own account; like the words of a language, wherein we do not attend to the ſound, but to the ſenſe.

SECT.

SECT. X.

Whether in ſenſation the mind is active or paſſive?

THERE is one inquiry remains, Whether in ſmelling, and in other ſenſations, the mind is active or paſſive? This poſſibly may ſeem to be a queſtion about words, or at leaſt of very ſmall importance; however, if it lead us to attend more accurately to the operations of our minds, than we are accuſtomed to do, it is upon that very account not altogether unprofitable. I think the opinion of modern philoſophers is, that in ſenſation the mind is altogether paſſive. And this undoubtedly is ſo far true, that we cannot raiſe any ſenſation in our minds by willing it; and, on the other hand, it ſeems hardly poſſible to avoid having the ſenſation, when the object is preſented. Yet it ſeems likewiſe to be true, that in proportion as the attention is more or leſs turned to a ſenſation, or diverted from it, that ſenſation is more or leſs perceived

perceived and remembered. Every one knows, that very intenſe pain may be diverted by a ſurpriſe, or by any thing that entirely occupies the mind. When we are engaged in earneſt converſation, the clock may ſtrike by us without being heard; at leaſt we remember not the next moment that we did hear it. The noiſe and tumult of a great trading city, is not heard by them who have lived in it all their days; but it ſtuns thoſe ſtrangers who have lived in the peaceful retirement of the country. Whether therefore there can be any ſenſation where the mind is purely paſſive, I will not ſay; but I think we are conſcious of having given ſome attention to every ſenſation which we remember, though ever ſo recent.

No doubt, where the impulſe is ſtrong and uncommon, it is as difficult to withhold attention, as it is to forbear crying out in racking pain, or ſtarting in a ſudden fright: but how far both might be attained by ſtrong reſolution and practice, is not eaſy to determine. So that, although the PERIPATETICS had no good reaſon to ſuppoſe an active and a paſſive intellect, ſince attention may be well enough

enough accounted an act of the will; yet I think they came nearer to the truth, in holding the mind to be in ſenſation partly paſſive and partly active, than the moderns, in affirming it to be purely paſſive. Senſation, imagination, memory, and judgment, have, by the vulgar, in all ages, been conſidered as acts of the mind. The manner in which they are expreſſed, in all languages, ſhews this. When the mind is much employed in them, we ſay it is very active; whereas, if they were impreſſions only, as the ideal philoſophy would lead us to conceive, we ought in ſuch a caſe rather to ſay, that the mind is very paſſive: for I ſuppoſe no man would attribute great activity to the paper I write upon, becauſe it receives variety of characters.

The relation which the ſenſation of ſmell bears to the memory and imagination of it, and to a mind or ſubject, is common to all our ſenſations, and indeed to all the operations of the mind: the relation it bears to the will, is common to it with all the powers of underſtanding: and the relation it bears to that quality or virtue of bodies which it indicates, is common to it with the ſenſations of

of taſte, hearing, colour, heat, and cold: ſo that what hath been ſaid of this ſenſe, may eaſily be applied to ſeveral of our ſenſes, and to other operations of the mind; and this, I hope, will apologize for our inſiſting ſo long upon it.

CHAP.

CHAP. III.

OF TASTING.

A GREAT part of what hath been ſaid of the ſenſe of ſmelling, is ſo eaſily applied to thoſe of taſting and hearing, that we ſhall leave the application entirely to the reader's judgment, and ſave ourſelves the trouble of a tedious repetition.

It is probable that every thing that affects the taſte, is in ſome degree ſoluble in the *ſaliva*. It is not conceivable how any thing ſhould enter readily, and of its own accord, as it were, into the pores of the tongue, palate, and *fauces*, unleſs it had ſome chemical affinity to that liquor with which theſe pores are always replete. It is therefore an admirable contrivance of nature, that the organs of taſte ſhould always be moiſt with a liquor which is ſo univerſal a menſtruum, and which deſerves to be examined more than it hath been hitherto, both in that capacity, and as a medical unguent. Nature teaches dogs, and

other animals, to uſe it in this laſt way; and its ſubſerviency both to taſte and digeſtion, ſhews its efficacy in the former.

It is with manifeſt deſign and propriety, that the organ of this ſenſe guards the entrance of the alimentary canal, as that of ſmell, the entrance of the canal for reſpiration. And from theſe organs being placed in ſuch manner, that every thing that enters into the ſtomach muſt undergo the ſcrutiny of both ſenſes, it is plain, that they were intended by nature to diſtinguiſh wholeſome food from that which is noxious. The brutes have no other means of chooſing their food; nor would mankind, in the ſavage ſtate. And it is very probable, that the ſmell and taſte, no way vitiated by luxury or bad habits, would rarely, if ever, lead us to a wrong choice of food among the productions of nature; although the artificial compoſitions of a refined and luxurious cookery, or of chemiſtry and pharmacy, may often impoſe upon both, and produce things agreeable to the taſte and ſmell, which are noxious to health. And it is probable, that both ſmell and taſte are vitiated, and rendered leſs fit to perform their natural offices, by the unnatural kind of life men commonly lead in ſociety.

Theſe

Theſe ſenſes are likewiſe of great uſe to diſtinguiſh bodies that cannot be diſtinguiſhed by our other ſenſes, and to diſcern the changes which the ſame body undergoes, which in many caſes are ſooner perceived by taſte and ſmell than by any other means. How many things are there in the market, the eating-houſe, and the tavern, as well as in the apothecary and chemiſt's ſhops, which are known to be what they are given out to be, and are perceived to be good or bad in their kind, only by taſte or ſmell? And how far our judgment of things, by means of our ſenſes, might be improved by accurate attention to the ſmall differences of taſte and ſmell, and other ſenſible qualities, is not eaſy to determine. Sir ISAAC NEWTON, by a noble effort of his great genius, attempted from the colour of opaque bodies, to diſcover the magnitude of the minute pellucid parts, of which they are compounded: and who knows what new lights natural philoſophy may yet receive from other ſecondary qualities duly examined?

Some taſtes and ſmells ſtimulate the nerves, and raiſe the ſpirits: but ſuch an artificial elevation of the ſpirits is, by the laws of nature, followed by a depreſſion, which can only

ly be relieved by time, or by the repeated uſe of the like *ſtimulus*. By the uſe of ſuch things we create an appetite for them, which very much reſembles, and hath all the force of a natural one. It is in this manner that men acquire an appetite for ſnuff, tobacco, ſtrong liquors, laudanum, and the like.

Nature indeed ſeems ſtudiouſly to have ſet bounds to the pleaſures and pains we have by theſe two ſenſes, and to have confined them within very narrow limits, that we might not place any part of our happineſs in them; there being hardly any ſmell or taſte ſo diſagreeable that uſe will not make it tolerable, and at laſt perhaps agreeable; nor any ſo agreeable as not to loſe its reliſh by conſtant uſe. Neither is there any pleaſure or pain of theſe ſenſes which is not introduced, or followed, by ſome degree of its contrary, which nearly balances it. So that we may here apply the beautiful allegory of the divine SOCRATES; That although pleaſure and pain are contrary in their nature, and their faces look different ways, yet Jupiter hath tied them ſo together, that he that lays hold of the one, draws the other along with it.

As there is a great variety of ſmells, ſeemingly ſimple and uncompounded, not only altogether

together unlike, but ſome of them contrary to others; and as the ſame thing may be ſaid of taſtes; it would ſeem that one taſte is not leſs different from another than it is from a ſmell: and therefore it may be a queſtion, how all ſmells come to be conſidered as one *genus*, and all taſtes as another? What is the generical diſtinction? Is it only that the noſe is the organ of the one, and the palate of the other? or, abſtracting from the organ, is there not in the ſenſations themſelves ſomething common to ſmells, and ſomething elſe common to taſtes, whereby the one is diſtinguiſhed from the other? It ſeems moſt probable that the latter is the caſe; and that under the appearance of the greateſt ſimplicity, there is ſtill in theſe ſenſations ſomething of compoſition.

If one conſiders the matter abſtractly, it would ſeem, that a number of ſenſations, or indeed of any other individual things, which are perfectly ſimple and uncompounded, are incapable of being reduced into *genera* and *ſpecies*; becauſe individuals which belong to a ſpecies, muſt have ſomething peculiar to each, by which they are diſtinguiſhed, and ſomething common to the whole ſpecies. And the ſame may be ſaid of *ſpecies* which be-

long to one *genus*. And whether this does not imply ſome kind of compoſition, we ſhall leave to metaphyſicians to determine.

The ſenſations both of ſmell and taſte do undoubtedly admit of an immenſe variety of modifications, which no language can expreſs. If a man was to examine five hundred different wines, he would hardly find two of them that had preciſely the ſame taſte: the ſame thing holds in cheeſe, and in many other things. Yet of five hundred different taſtes in cheeſe or wine, we can hardly deſcribe twenty, ſo as to give a diſtinct notion of them to one who had not taſted them.

Dr NEHEMIAH GREW, a moſt judicious and laborious naturaliſt, in a diſcourſe read before the Royal Society, *anno* 1675, hath endeavoured to ſhow, that there are at leaſt ſixteen different ſimple taſtes, which he enumerates. How many compound ones may be made out of all the various combinations of two, three, four, or more of theſe ſimple ones, they who are acquainted with the theory of combinations will eaſily perceive. All theſe have various degrees of intenſeneſs and weakneſs. Many of them have other varieties: in ſome the taſte is more quickly perceived upon the application of the ſapid body, in others

others more ſlowly; in ſome the ſenſation is more permanent, in others more tranſient; in ſome it ſeems to undulate, or return after certain intervals, in others it is conſtant: the various parts of the organ, as the lips, the tip of the tongue, the root of the tongue, the *fauces*, the *uvula*, and the throat, are ſome of them chiefly affected by one ſapid body, and others by another. All theſe, and other varieties of taſtes, that accurate writer illuſtrates by a number of examples. Nor is it to be doubted, but ſmells, if examined with the ſame accuracy, would appear to have as great variety.

CHAP. IV.

OF HEARING.

SECT. I.

Variety of ſounds. Their place and diſtance learned by cuſtom, without reaſoning.

SOUNDS have probably no leſs variety of modifications, than either taſtes or odours. For, firſt, ſounds differ in tone. The ear is capable of perceiving four or five hundred variations of tone in ſound, and probably as many different degrees of ſtrength; by combining theſe, we have above twenty thouſand ſimple ſounds that differ either in tone or ſtrength, ſuppoſing every tone to be perfect. But it is to be obſerved, that to make a perfect tone, a great many undulations of elaſtic air are required, which muſt all be of equal duration and extent, and follow one another with perfect regularity; and each undulation

undulation muſt be made up of the advance and recoil of innumerable particles of elaſtic air, whoſe motions are all uniform in direction, force, and time. Hence we may eaſily conceive a prodigious variety in the ſame tone, ariſing from irregularities of it, occaſioned by the conſtitution, figure, ſituation, or manner of ſtriking the ſonorous body: from the conſtitution of the elaſtic medium, or its being diſturbed by other motions; and from the conſtitution of the ear itſelf, upon which the impreſſion is made.

A flute, a violin, a hautboy, and a French horn, may all ſound the ſame tone, and be eaſily diſtinguiſhable. Nay, if twenty human voices ſound the ſame note, and with equal ſtrength, there will ſtill be ſome difference. The ſame voice, while it retains its proper diſtinctions, may yet be varied many ways, by ſickneſs or health, youth or age, leanneſs or fatneſs, good or bad humour. The ſame words ſpoken by foreigners and natives, nay, by perſons of different provinces of the ſame nation, may be diſtinguiſhed.

Such an immenſe variety of ſenſations of ſmell, taſte, and ſound, ſurely was not given us in vain. They are ſigns, by which we know and diſtinguiſh things without us; and it

it was fit that the variety of the ſigns ſhould, in ſome degree, correſpond with the variety of things ſignified by them.

It ſeems to be by cuſtom, that we learn to diſtinguiſh both the place of things, and their nature, by means of their ſound. That ſuch a noiſe is in the ſtreet, ſuch another in the room above me; that this is a knock at my door, that, a perſon walking up ſtairs; is probably learnt by experience. I remember, that once lying abed, and having been put into a fright, I heard my own heart beat; but I took it to be one knocking at the door, and aroſe and opened the door oftener than once, before I diſcovered that the ſound was in my own breaſt. It is probable, that previous to all experience, we ſhould as little know, whether a ſound came from the right or left, from above or below, from a great or a ſmall diſtance, as we ſhould know whether it was the ſound of a drum, or a bell, or a cart. Nature is frugal in her operations, and will not be at the expence of a particular inſtinct, to give us that knowledge which experience will ſoon produce, by means of a general principle of human nature.

For a little experience, by the conſtitution of human nature, ties together, not only in our

our imagination, but in our belief, thoſe things which were in their nature unconnected. When I hear a certain ſound, I conclude immediately, without reaſoning, that a coach paſſes by. There are no premiſes from which this concluſion is inferred by any rules of logic. It is the effect of a principle of our nature, common to us with the brutes.

Although it is by hearing, that we are capable of the perceptions of harmony and melody, and of all charms of muſic; yet it would ſeem, that theſe require a higher faculty, which we call *a muſical ear.* This ſeems to be in very different degrees, in thoſe who have the bare faculty of hearing equally perfect; and therefore ought not to be claſſed with the external ſenſes, but in a higher order.

SECT.

SECT. II.

Of natural language.

ONE of the nobleſt purpoſes of ſound undoubtedly is language; without which mankind would hardly be able to attain any degree of improvement above the brutes. Language is commonly conſidered as purely an invention of men, who by nature are no leſs mute than the brutes, but having a ſuperior degree of invention and reaſon, have been able to contrive artificial ſigns of their thoughts and purpoſes, and to eſtabliſh them by common conſent. But the origin of language deſerves to be more carefully inquired into, not only as this inquiry may be of importance for the improvement of language, but as it is related to the preſent ſubject, and tends to lay open ſome of the firſt principles of human nature. I ſhall therefore offer ſome thoughts upon this ſubject.

By language, I underſtand all thoſe ſigns which mankind uſe in order to communicate

to

to others their thoughts and intentions, their purpoſes and deſires. And ſuch ſigns may be conceived to be of two kinds: Firſt, ſuch as have no meaning, but what is affixed to them by compact or agreement among thoſe who uſe them; theſe are artificial ſigns: Secondly, ſuch as, previous to all compact or agreement, have a meaning which every man underſtands by the principles of his nature. Language, ſo far as it conſiſts of artificial ſigns, may be called *artificial;* ſo far as it conſiſts of natural ſigns, I call it *natural.*

Having premiſed theſe definitions, I think it is demonſtrable, that if mankind had not a natural language, they could never have invented an artificial one by their reaſon and ingenuity. For all artificial language ſuppoſes ſome compact or ageement to affix a certain meaning to certain ſigns; therefore there muſt be compacts or agreements before the uſe of artificial ſigns; but there can be no compact or agreement without ſigns, nor without language; and therefore there muſt be a natural language before any artificial language can be invented: Which was to be demonſtrated.

Had language in general been a human invention, as much as writing or printing, we ſhould

ſhould find whole nations as mute as the brutes. Indeed even the brutes have ſome natural ſigns by which they expreſs their own thoughts, affections, and deſires, and underſtand thoſe of others. A chick, as ſoon as hatched, underſtands the different ſounds whereby its dam calls it to food, or gives the alarm of danger. A dog or a horſe underſtands, by nature, when the human voice careſſes, and when it threatens him. But brutes, as far as we know, have no notion of contracts or covenants, or of moral obligation to perform them. If nature had given them theſe notions, ſhe would probably have given them natural ſigns to expreſs them. And where nature has denied theſe notions, it is as impoſſible to acquire them by art, as it is for a blind man to acquire the notion of colours, Some brutes are ſenſible of honour or diſgrace; they have reſentment and gratitude; but none of them, as far as we know, can make a promiſe, or plight their faith, having no ſuch notions from their conſtitution. And if mankind had not theſe notions by nature, and natural ſigns to expreſs them by, with all their wit and ingenuity they could never have invented language.

The

The elements of this natural language of mankind, or the ſigns that are naturally expreſſive of our thoughts, may, I think, be reduced to theſe three kinds; modulations of the voice, geſtures, and features. By means of theſe, two ſavages who have no common artificial language, can converſe together; can communicate their thoughts in ſome tolerable manner; can aſk and refuſe, affirm and deny, threaten and ſupplicate; can traffic, enter into covenants, and plight their faith. This might be confirmed by hiſtorical facts of undoubted credit, if it were neceſſary.

Mankind having thus a common language by nature, though a ſcanty one, adapted only to the neceſſities of nature, there is no great ingenuity required in improving it by the addition of artificial ſigns, to ſupply the deficiency of the natural. Theſe artificial ſigns muſt multiply with the arts of life, and the improvements of knowledge. The articulations of the voice, ſeem to be, of all ſigns, the moſt proper for artificial language; and as mankind have univerſally uſed them for that purpoſe, we may reaſonably judge that nature intended them for it. But nature probably does not intend that we ſhould lay aſide

aſide the uſe of the natural ſigns; it is enough that we ſupply their defects by artificial ones. A man that rides always in a chariot, by degrees loſes the uſe of his legs; and one who uſes artificial ſigns only, loſes both the knowledge and uſe of the natural. Dumb people retain much more of the natural language than others, becauſe neceſſity obliges them to uſe it. And for the ſame reaſon, ſavages have much more of it than civilized nations. It is by natural ſigns chiefly that we give force and energy to language; and the leſs language has of them, it is the leſs expreſſive and perſuaſive. Thus, writing is leſs expreſſive than reading, and reading leſs expreſſive than ſpeaking without book; ſpeaking without the proper and natural modulations, force, and variations of the voice, is a frigid and dead language, compared with that which is attended with them; it is ſtill more expreſſive when we add the language of the eyes and features; and is then only in its perfect and natural ſtate, and attended with its proper energy, when to all theſe we ſuperadd the force of action.

Where ſpeech is natural, it will be an exerciſe, not of the voice and lungs only, but of all the muſcles of the body; like that of dumb

dumb people and ſavages, whoſe language, as it has more of nature, is more expreſſive, and is more eaſily learned.

Is it not pity that the refinements of a civilized life, inſtead of ſupplying the defects of natural language, ſhould root it out, and plant in its ſtead dull and lifeleſs articulations of unmeaning ſounds, or the ſcrawling of inſignificant characters? The perfection of language is commonly thought to be, to expreſs human thoughts and ſentiments diſtinctly by theſe dull ſigns; but if this is the perfection of artificial language, it is ſurely the corruption of the natural.

Artificial ſigns ſignify, but they do not expreſs; they ſpeak to the underſtanding, as algebraical characters may do, but the paſſions, the affections, and the will, hear them not: theſe continue dormant and inactive, till we ſpeak to them in the language of nature, to which they are all attention and obedience.

It were eaſy to ſhew, that the fine arts of the muſician, the painter, the actor, and the orator, ſo far as they are expreſſive; although the knowledge of them requires in us a delicate taſte, a nice judgment, and much ſtudy and practice; yet they are nothing elſe but the language of nature, which we brought

into the world with us, but have unlearned by diſuſe, and ſo find the greateſt difficulty in recovering it.

Aboliſh the uſe of articulate ſounds and writing among mankind for a century, and every man would be a painter, an actor, and an orator. We mean not to affirm that ſuch an expedient is practicable; or, if it were, that the advantage would counterbalance the loſs; but that, as men are led by nature and neceſſity to converſe together, they will uſe every mean in their power to make themſelves underſtood; and where they cannot do this by artificial ſigns, they will do it, as far as poſſible, by natural ones: and he that underſtands perfectly the uſe of natural ſigns, muſt be the beſt judge in all the expreſſive arts.

CHAP.

CHAP. V.

OF TOUCH.

SECT. I.

Of heat and cold.

THE ſenſes which we have hitherto conſidered, are very ſimple and uniform, each of them exhibiting only one kind of ſenſation, and thereby indicating only one quality of bodies. By the ear we perceive ſounds, and nothing elſe; by the palate, taſtes; and by the noſe, odours: Theſe qualities are all likewiſe of one order, being all ſecondary qualities: Whereas by touch we perceive not one quality only, but many, and thoſe of very different kinds. The chief of them are heat and cold, hardneſs and ſoftneſs, roughneſs and ſmoothneſs, figure, ſolidity, motion, and extenſion. We ſhall conſider theſe in order.

As to heat and cold, it will eaſily be allowed that they are ſecondary qualities, of the ſame order with ſmell, taſte, and ſound. And, therefore, what hath been already ſaid of ſmell, is eaſily applicable to them; that is, that the words *heat* and *cold* have each of them two ſignifications; they ſometimes ſignify certain ſenſations of the mind, which can have no exiſtence when they are not felt, nor can exiſt anywhere but in a mind or ſentient being; but more frequently they ſignify a quality in bodies, which, by the laws of nature, occaſions the ſenſations of heat and cold in us: A quality which, though connected by cuſtom ſo cloſely with the ſenſation, that we cannot without difficulty ſeparate them; yet hath not the leaſt reſemblance to it, and may continue to exiſt when there is no ſenſation at all.

The ſenſations of heat and cold are perfectly known; for they neither are, nor can be, any thing elſe than what we feel them to be; but the qualities in bodies which we call *heat* and *cold*, are unknown. They are only conceived by us, as unknown cauſes or occaſions of the ſenſations to which we give the ſame names. But though common ſenſe ſays nothing of the nature of theſe qualities, it plainly

ly dictates the exiſtence of them; and to deny that there can be heat and cold when they are not felt, is an abſurdity too groſs to merit confutation. For what could be more abſurd, than to ſay, that the thermometer cannot riſe or fall, unleſs ſome perſon be preſent, or that the coaſt of Guinea would be as cold as Nova Zembla, if it had no inhabitants?

It is the buſineſs of philoſophers to inveſtigate, by proper experiments and induction, what heat and cold are in bodies. And whether they make heat a particular element diffuſed through nature, and accumulated in the heated body, or whether they make it a certain vibration of the parts of the heated body; whether they determine that heat and cold are contrary qualities, as the ſenſations undoubtedly are contrary, or that heat only is a quality, and cold its privation: theſe queſtions are within the province of philoſophy; for common ſenſe ſays nothing on the one ſide or the other.

But whatever be the nature of that quality in bodies which we call *heat*, we certainly know this, that it cannot in the leaſt reſemble the ſenſation of heat. It is no leſs abſurd to ſuppoſe a likeneſs between the ſenſation and the quality, than it would be to ſuppoſe, that

the pain of the gout reſembles a ſquare or a triangle. The ſimpleſt man that hath common ſenſe, does not imagine the ſenſation of heat, or any thing that reſembles that ſenſation, to be in the fire. He only imagines, that there is ſomething in the fire, which makes him and other ſentient beings feel heat. Yet as the name of *heat*, in common language, more frequently and more properly ſignifies this unknown ſomething in the fire, than the ſenſation occaſioned by it, he juſtly laughs at the philoſopher, who denies that there is any heat in the fire, and thinks that he ſpeaks contrary to common ſenſe.

SECT. II.

Of hardneſs and ſoftneſs.

LET us next conſider hardneſs and ſoftneſs; by which words we always underſtand real properties or qualities of bodies of which we have a diſtinct conception.

When the parts of a body adhere ſo firmly that it cannot eaſily be made to change its figure,

figure, we call it *hard;* when its parts are eaſily diſplaced, we call it *ſoft.* This is the notion which all mankind have of hardneſs and ſoftneſs: they are neither ſenſations, nor like any ſenſation; they were real qualities before they were perceived by touch, and continue to be ſo when they are not perceived: for if any man will affirm, that diamonds were not hard till they were handled, who would reaſon with him?

There is, no doubt, a ſenſation by which we perceive a body to be hard or ſoft. This ſenſation of hardneſs may eaſily be had, by preſſing one's hand againſt the table, and attending to the feeling that enſues, ſetting aſide, as much as poſſible, all thought of the table and its qualities, or of any external thing. But it is one thing to have the ſenſation, and another to attend to it, and make it a diſtinct object of reflection. The firſt is very eaſy; the laſt, in moſt caſes, extremely difficult.

We are ſo accuſtomed to uſe the ſenſation as a ſign, and to paſs immediately to the hardneſs ſignified, that, as far as appears, it was never made an object of thought, either by the vulgar or by philoſophers; nor has it a name in any language. There is no ſenſation more diſtinct, or more frequent; yet it is ne-

ver attended to, but paſſes through the mind inſtantaneouſly, and ſerves only to introduce, that quality in bodies, which, by a law of our conſtitution, it ſuggeſts.

There are indeed ſome caſes, wherein it is no difficult matter to attend to the ſenſation occaſioned by the hardneſs of a body; for inſtance, when it is ſo violent as to occaſion conſiderable pain: then nature calls upon us to attend to it, and then we acknowledge, that it is a mere ſenſation, and can only be in a ſentient being. If a man runs his head with violence againſt a pillar, I appeal to him, whether the pain he feels reſembles the hardneſs of the ſtone; or if he can conceive any thing like what he feels, to be in an inanimate piece of matter.

The attention of the mind is here entirely turned towards the painful feeling; and, to ſpeak in the common language of mankind, he feels nothing in the ſtone, but feels a violent pain in his head. It is quite otherwiſe when he leans his head gently againſt the pillar; for then he will tell you that he feels nothing in his head, but feels hardneſs in the ſtone. Hath he not a ſenſation in this caſe as well as in the other? Undoubtedly he hath: but it is a ſenſation which nature intended

tended only as a ſign of ſomething in the ſtone; and, accordingly, he inſtantly fixes his attention upon the thing ſignified; and cannot, without great difficulty, attend ſo much to the ſenſation, as to be perſuaded that there is any ſuch thing diſtinct from the hardneſs it ſignifies.

But however difficult it may be to attend to this fugitive ſenſation, to ſtop its rapid progreſs, and to disjoin it from the external quality of hardneſs, in whoſe ſhadow it is apt immediately to hide itſelf; this is what a philoſopher by pains and practice muſt attain, otherwiſe it will be impoſſible for him to reaſon juſtly upon this ſubject, or even to underſtand what is here advanced. For the laſt appeal, in ſubjects of this nature, muſt be to what a man feels and perceives in his own mind.

It is indeed ſtrange, that a ſenſation which we have every time we feel a body hard, and which, conſequently, we can command as often, and continue as long as we pleaſe, a ſenſation as diſtinct and determinate as any other, ſhould yet be ſo much unknown, as never to have been made an object of thought and reflection, nor to have been honoured with a name in any language; that philoſophers,

phers, as well as the vulgar, ſhould have entirely overlooked it, or confounded it with that quality of bodies, which we call *hardneſs* to which it hath not the leaſt ſimilitude. May we not hence conclude, That the knowledge of the human faculties is but in its infancy? That we have not yet learned to attend to thoſe operations of the mind, of which we are conſcious every hour of our lives? That there are habits of inattention acquired very early, which are as hard to be overcome as other habits? For I think it is probable, that the novelty of this ſenſation will procure ſome attention to it in children at firſt; but being in nowiſe intereſting in itſelf, as ſoon as it becomes familiar, it is overlooked, and the attention turned ſolely to that which it ſignifies. Thus, when one is learning a language, he attends to the ſounds; but when he is maſter of it, he attends only to the ſenſe of what he would expreſs. If this is the caſe, we muſt become as little children again, if we will be philoſophers: we muſt overcome this habit of inattention which has been gathering ſtrength ever ſince we began to think; a habit, the uſefulneſs of which, in common life, atones for the difficulty it creates

creates to the philoſopher, in diſcovering the firſt principles of the human mind.

The firm coheſion of the parts of a body, is no more like that ſenſation by which I perceive it to be hard, than the vibration of a ſonorous body is like the ſound I hear: nor can I poſſibly perceive, by my reaſon, any connection between the one and the other. No man can give a reaſon, why the vibration of a body might not have given the ſenſation of ſmelling, and the effluvia of bodies affected our hearing, if it had ſo pleaſed our Maker: In like manner, no man can give a reaſon, why the ſenſations of ſmell, or taſte, or ſound, might not have indicated hardneſs, as well as that ſenſation, which, by our conſtitution, does indicate it. Indeed no man can conceive any ſenſation to reſemble any known quality of bodies. Nor can any man ſhew, by any good argument, that all our ſenſations might not have been as they are, though no body, nor quality of body, had ever exiſted.

Here, then, is a phenomenon of human nature, which comes to be reſolved. Hardneſs of bodies is a thing that we conceive as diſtinctly, and believe as firmly, as any thing in nature. We have no way of coming at this conception and belief, but by means of a certain

tain ſenſation of touch, to which hardneſs hath not the leaſt ſimilitude; nor can we, by any rules of reaſoning, infer the one from the other. The queſtion is, How we come by this conception and belief?

Firſt, as to the conception: Shall we call it an idea of ſenſation, or of reflection? The laſt will not be affirmed; and as little can the firſt, unleſs we will call that an idea of ſenſation, which hath no reſemblance to any ſenſation. So that the origin of this idea of hardneſs, one of the moſt common and moſt diſtinct we have, is not to be found in all our ſyſtems of the mind: not even in thoſe which have ſo copiouſly endeavoured to deduce all our notions from ſenſations and reflection.

But, ſecondly, ſuppoſing we have got the conception of hardneſs, how come we by the belief of it? Is it ſelf-evident, from comparing the ideas, that ſuch a ſenſation could not be felt, unleſs ſuch a quality of bodies exiſted? No. Can it be proved by probable or certain arguments? No, it cannot. Have we got this belief, then, by tradition, by education, or by experience? No, it is not got in any of theſe ways. Shall we then throw off this belief, as having no foundation in reaſon?

ſon? Alas! it is not in our power; it triumphs over reaſon, and laughs at all the arguments of a philoſopher. Even the author of the *Treatiſe of Human Nature*, though he ſaw no reaſon for this belief, but many againſt it, could hardly conquer it in his ſpeculative and ſolitary moments; at other times he fairly yielded to it, and confeſſes that he found himſelf under a neceſſity to do ſo.

What ſhall we ſay then of this conception, and this belief, which are ſo unaccountable and untractable? I ſee nothing left, but to conclude, that by an original principle of our conſtitution, a certain ſenſation of touch both ſuggeſts to the mind the conception of hardneſs, and creates the belief of it: or, in other words, that this ſenſation is a natural ſign of hardneſs. And this I ſhall endeavour more fully to explain.

SECT.

SECT. III.

Of natural ſigns.

AS in artificial ſigns there is often neither ſimilitude between the ſign and thing ſignified, nor any connection that ariſes neceſſarily from the nature of the things; ſo it is alſo in natural ſigns. The word *gold* has no ſimilitude to the ſubſtance ſignified by it; nor is it in its own nature more fit to ſignify this than any other ſubſtance: yet, by habit and cuſtom, it ſuggeſts this and no other. In like manner, a ſenſation of touch ſuggeſts hardneſs, although it hath neither ſimilitude to hardneſs, nor, as far as we can perceive, any neceſſary connection with it. The difference betwixt theſe two ſigns lies only in this, that, in the firſt, the ſuggeſtion is the effect of habit and cuſtom; in the ſecond, it is not the effect of habit, but of the original conſtitution of our minds.

It appears evident from what hath been ſaid on the ſubject of language, that there are natural ſigns, as well as artificial; and particularly,

cularly, That the thoughts, purpoſes, and diſpoſitions of the mind, have their natural ſigns in the features of the face, the modulation of the voice, and the motion and attitude of the body: That without a natural knowledge of the connection between theſe ſigns, and the things ſignified by them, language could never have been invented and eſtabliſhed among men: and, That the fine arts are all founded upon this connection, which we may call *the natural language of mankind.* It is now proper to obſerve, that there are different orders of natural ſigns, and to point out the different claſſes into which they may be diſtinguiſhed, that we may more diſtinctly conceive the relation between our ſenſations and the things they ſuggeſt, and what we mean by calling ſenſations ſigns of external things.

The firſt claſs of natural ſigns comprehends thoſe whoſe connection with the thing ſignified is eſtabliſhed by nature, but diſcovered only by experience. The whole of genuine philoſophy conſiſts in diſcovering ſuch connections, and reducing them to general rules. The great Lord Verulam had a perfect comprehenſion of this, when he called it *an interpretation of nature.* No man ever more diſtinctly underſtood, or happily expreſſed, the nature

nature and foundation of the philoſophic art. What is all we know of mechanics, aſtronomy, and optics, but connections eſtabliſhed by nature, and diſcovered by experience or obſervation, and conſequences deduced from them? All the knowledge we have in agriculture, gardening, chemiſtry, and medicine, is built upon the ſame foundation. And if ever our philoſophy concerning the human mind is carried ſo far as to deſerve the name of ſcience, which ought never to be deſpaired of, it muſt be by obſerving facts, reducing them to general rules, and drawing juſt concluſions from them. What we commonly call natural *cauſes*, might, with more propriety, be called natural *ſigns*, and what we call *effects*, the *things ſignified*. The cauſes have no proper efficiency or caſualty, as far as we know; and all we can certainly affirm, is, that nature hath eſtabliſhed a conſtant conjunction between them and the things called their effects; and hath given to mankind a diſpoſition to obſerve thoſe connections, to confide in their continuance, and to make uſe of them for the improvement of our knowledge, and increaſe of our power.

A ſecond claſs is that wherein the connection between the ſign and thing ſignified, is not

not only eſtabliſhed by nature, but diſcovered to us by a natural principle, without reaſoning or experience. Of this kind are the natural ſigns of human thoughts, purpoſes, and deſires, which have been already mentioned as the natural language of mankind. An infant may be put into a fright by an angry countenance, and ſoothed again by ſmiles and blandiſhments. A child that has a good muſical ear, may be put to ſleep or to dance, may be made merry or ſorrowful, by the modulation of muſical ſounds. The principles of all the fine arts, and of what we call *a fine taſte*, may be reſolved into connections of this kind. A fine taſte may be improved by reaſoning and experience; but if the firſt principles of it were not planted in our minds by nature, it could never be acquired. Nay, we have already made it appear, that a great part of this knowledge, which we have by nature, is loſt by the diſuſe of natural ſigns, and the ſubſtitution of artificial in their place.

A third claſs of natural ſigns comprehends thoſe which, though we never before had any notion or conception of the things ſignified, do ſuggeſt it, or conjure it up, as it were, by a natural kind of magic, and at once give us a conception, and create a belief of it. I

ſhewed formerly, that our ſenſations ſuggeſt to us a ſentient being or mind to which they belong: a being which hath a permanent exiſtence, although the ſenſations are tranſient and of ſhort duration: a being which is ſtill the ſame, while its ſenſations and other operations are varied ten thouſand ways: a being which hath the ſame relation to all that infinite variety of thoughts, purpoſes, actions, affections, enjoyments, and ſufferings, which we are conſcious of, or can remember. The conception of a mind is neither an idea of ſenſation nor of reflection; for it is neither like any of our ſenſations, nor like any thing we are conſcious of. The firſt conception of it, as well as the belief of it, and of the common relation it bears to all that we are conſcious of, or remember, is ſuggeſted to every thinking being, we do not know how.

The notion of hardneſs in bodies, as well as the belief of it, are got in a ſimilar manner; being by an original principle of our nature, annexed to that ſenſation which we have when we feel a hard body. And ſo naturally and neceſſarily does the ſenſation convey the notion and belief of hardneſs, that hitherto they have been confounded by the moſt acute inquirers into the principles of human

human nature, although they appear, upon accurate reflection, not only to be different things, but as unlike as pain is to the point of a ſword.

It may be obſerved, that as the firſt claſs of natural ſigns I have mentioned, is the foundation of true philoſophy, and the ſecond, the foundation of the fine arts, or of taſte; ſo the laſt is the foundation of common ſenſe; a part of human nature which hath never been explained.

I take it for granted, that the notion of hardneſs, and the belief of it, is firſt got by means of that particular ſenſation, which, as far back as we can remember, does invariably ſuggeſt it; and that if we had never had ſuch a feeling, we ſhould never have had any notion of hardneſs. I think it is evident, that we cannot, by reaſoning from our ſenſations, collect the exiſtence of bodies at all, far leſs any of their qualities. This hath been proved by unanſwerable arguments by the Biſhop of Cloyne, and by the author of the *Treatiſe of Human Nature*. It appears as evident, that this connection between our ſenſations and the conception and belief of external exiſtences, cannot be produced by habit, experience, education, or any principle of

human nature that hath been admitted by philoſophers. At the ſame time, it is a fact, that ſuch ſenſations are invariably connected with the conception and belief of external exiſtences. Hence, by all rules of juſt reaſoning, we muſt conclude, that this connection is the effect of our conſtitution, and ought to be conſidered as an original principle of human nature, till we find ſome more general principle into which it may be reſolved.

SECT. IV.

Of hardneſs, and other primary qualities.

FURTHER I obſerve, that hardneſs is a quality, of which we have as clear and diſtinct a conception as of any thing whatſoever. The coheſion of the parts of a body with more or leſs force, is perfectly underſtood, though its cauſe is not: we know what it is, as well as how it affects the touch. It is therefore a quality of a quite different order from thoſe ſecondary qualities we have already taken notice of, whereof we know no more naturally,

turally, than that they are adapted to raiſe certain ſenſations in us. If hardneſs were a quality of the ſame kind, it would be a proper inquiry for philoſophers, What hardneſs in bodies is? and we ſhould have had various hypotheſes about it, as well as about colour and heat. But it is evident that any ſuch hypotheſis would be ridiculous. If any man ſhould ſay, that hardneſs in bodies is a certain vibration of their parts, or that it is certain effluvia emitted by them which affect our touch in the manner we feel; ſuch hypotheſes would ſhock common ſenſe; becauſe we all know, that if the parts of a body adhere ſtrongly, it is hard, although it ſhould neither emit effluvia, nor vibrate. Yet at the ſame time, no man can ſay, but that effluvia, or the vibration of the parts of a body, might have affected our touch, in the ſame manner that hardneſs now does, if it had ſo pleaſed the Author of our nature: and if either of theſe hypotheſes is applied to explain a ſecondary quality, ſuch as ſmell, or taſte, or ſound, or colour, or heat, there appears no manifeſt abſurdity in the ſuppoſition.

The diſtinction betwixt primary and ſecondary qualities hath had ſeveral revolutions. DEMOCRITUS and EPICURUS, and

their followers, maintained it. ARISTOTLE and the Peripatetics aboliſhed it. DES CARTES, MALEBRANCHE, and LOCKE, revived it, and were thought to have put it in a very clear light. But Biſhop BERKELEY again diſcarded this diſtinction, by ſuch proofs as muſt be convincing to thoſe that hold the received doctrine of ideas. Yet, after all, there appears to be a real foundation for it in the principles of our nature.

What hath been ſaid of hardneſs, is ſo eaſily applicable, not only to its oppoſite, ſoftneſs, but likewiſe to roughneſs and ſmoothneſs, to figure and motion, that we may be excuſed from making the application, which would only be a repetition of what hath been ſaid. All theſe, by means of certain correſponding ſenſations of touch, are preſented to the mind as real external qualities; the conception and the belief of them are invariably connected with the correſponding ſenſations, by an original principle of human nature. Their ſenſations have no name in any language; they have not only been overlooked by the vulgar, but by philoſophers; or if they have been at all taken notice of, they have been confounded with the external qualities which they ſuggeſt.

SECT.

SECT. V.

Of extenſion.

IT is further to be obſerved, that hardneſs and ſoftneſs, roughneſs and ſmoothneſs, figure and motion, do all ſuppoſe extenſion, and cannot be conceived without it; yet I think it muſt, on the other hand, be allowed, that if we had never felt any thing hard or ſoft, rough or ſmooth, figured or moved, we ſhould never have had a conception of extenſion: ſo that as there is good ground to believe, that the notion of extenſion could not be prior to that of other primary qualities; ſo it is certain that it could not be poſterior to the notion of any of them, being neceſſarily implied in them all.

Extenſion, therefore, ſeems to be a quality ſuggeſted to us, by the very ſame ſenſations which ſuggeſt the other qualities above mentioned. When I graſp a ball in my hand, I perceive it at once hard, figured and extended. The feeling is very ſimple, and hath not the leaſt reſemblance to any quality of body. Yet it ſuggeſts to us three primary qualities

perfectly distinct from one another, as well as from the sensation which indicates them. When I move my hand along the table, the feeling is so simple, that I find it difficult to distinguish it into things of different natures; yet it immediately suggests hardness, smoothness, extension, and motion, things of very different natures, and all of them as distinctly understood as the feeling which suggests them.

We are commonly told by philosophers, that we get the idea of extension by feeling along the extremities of a body, as if there was no manner of difficulty in the matter. I have sought, with great pains, I confess, to find out how this idea can be got by feeling, but I have sought in vain. Yet it is one of the clearest and most distinct notions we have; nor is there any thing whatsoever, about which the human understanding can carry on so many long and demonstrative trains of reasoning.

The notion of extension is so familiar to us from infancy, and so constantly obtruded by every thing we see and feel, that we are apt to think it obvious how it comes into the mind; but upon a narrower examination we shall find it utterly inexplicable. It is true

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we have feelings of touch, which every moment preſent extenſion to the mind; but how they come to do ſo, is the queſtion; for thoſe feelings do no more reſemble extenſion, than they reſemble juſtice or courage: nor can the exiſtence of extended things be inferred from thoſe feelings by any rules of reaſoning: ſo that the feelings we have by touch, can neither explain how we get the notion, nor how we come by the belief of extended things.

What hath impoſed upon philoſophers in this matter, is, that the feelings of touch, which ſuggeſt primary qualities, have no names, nor are they ever reflected upon. They paſs through the mind inſtantaneouſly, and ſerve only to introduce the notion and belief of external things, which by our conſtitution are connected with them. They are natural ſigns, and the mind immediately paſſes to the thing ſignified, without making the leaſt reflection upon the ſign, or obſerving that there was any ſuch thing. Hence it hath always been taken for granted, that the ideas of extenſion, figure, and motion, are ideas of ſenſation, which enter into the mind by the ſenſe of touch, in the ſame manner as the ſenſations of ſound and ſmell do by the ear and noſe. The ſenſations of touch are ſo connected, by our

our conſtitution, with the notions of extenſion, figure, and motion, that philoſophers have miſtaken the one for the other, and never have been able to diſcern that they were not only diſtinct things, but altogether unlike. However, if we will reaſon diſtinctly upon this ſubject, we ought to give names to thoſe feelings of touch; we muſt accuſtom ourſelves to attend to them, and to reflect upon them, that we may be able to disjoin them from, and to compare them with, the qualities ſignified or ſuggeſted by them.

The habit of doing this is not to be attained without pains and practice; and till a man hath acquired this habit, it will be impoſſible for him to think diſtinctly, or to judge right, upon this ſubject.

Let a man preſs his hand againſt the table: *he feels it hard.* But what is the meaning of this? the meaning undoubtedly is, that he hath a certain feeling of touch, from which he concludes, without any reaſoning, or comparing ideas, that there is ſomething external really exiſting, whoſe parts ſtick ſo firmly together, that they cannot be diſplaced without conſiderable force.

There is here a feeling, and a concluſion drawn from it, or ſome way ſuggeſted by it.

In

In order to compare theſe, we muſt view them ſeparately, and then conſider by what tie they are connected, and wherein they reſemble one another. The hardneſs of the table is the concluſion, the feeling is the medium by which we are led to that concluſion. Let a man attend diſtinctly to this medium, and to the concluſion, and he will perceive them to be as unlike as any two things in nature. The one is a ſenſation of the mind, which can have no exiſtence but in a ſentient being; nor can it exiſt one moment longer than it is felt; the other is in the table, and we conclude without any difficulty, that it was in the table before it was felt, and continues after the feeling is over. The one implies no kind of extenſion, nor parts, nor coheſion; the other implies all theſe. Both indeed admit of degrees; and the feeling, beyond a certain degree, is a ſpecies of pain; but adamantine hardneſs does not imply the leaſt pain.

And as the feeling hath no ſimilitude to hardneſs, ſo neither can our reaſon perceive the leaſt tie or connection between them; nor will the logician ever be able to ſhow a reaſon why we ſhould conclude hardneſs from this feeling, rather than ſoftneſs, or any other quality whatſoever. But in reality all mankind

kind are led by their conſtitution to conclude hardneſs from this feeling.

The ſenſation of heat, and the ſenſation we have by preſſing a hard body, are equally feelings: nor can we by reaſoning draw any concluſion from the one, but what may be drawn from the other: but, by our conſtitution, we conclude from the firſt an obſcure or occult quality, of which we have only this relative conception, that it is ſomething adapted to raiſe in us the ſenſation of heat; from the ſecond, we conclude a quality of which we have a clear and diſtinct conception, to wit, the hardneſs of the body.

SECT.

SECT. VI.

Of extenſion.

TO put this matter in another light, it may be proper to try, whether from ſenſation alone we can collect any notion of extenſion, figure, motion, and ſpace. I take it for granted, that a blind man hath the ſame notions of extenſion, figure, and motion, as a man that ſees; that Dr SAUNDERSON had the ſame notion of a cone, a cylinder, and a ſphere, and of the motions and diſtances of the heavenly bodies, as Sir ISAAC NEWTON.

As ſight therefore is not neceſſary for our acquiring thoſe notions, we ſhall leave it out altogether in our inquiry into the firſt origin of them; and ſhall ſuppoſe a blind man, by ſome ſtrange diſtemper, to have loſt all the experience and habits and notions he had got by touch; nor to have the leaſt conception of the exiſtence, figure, dimenſions, or extenſion, either of his own body, or of any other; but to have all his knowledge of external things to acquire anew, by means of ſenſation, and the

the power of reaſon, which we ſuppoſe to remain entire.

We ſhall, firſt, ſuppoſe his body fixed immoveably in one place, and that he can only have the feelings of touch, by the application of other bodies to it. Suppoſe him firſt to be pricked with a pin; this will, no doubt, give a ſmart ſenſation: he feels pain; but what can he infer from it? Nothing ſurely with regard to the exiſtence or figure of a pin. He can infer nothing from this ſpecies of pain, which he may not as well infer from the gout or ſciatica. Common ſenſe may lead him to think that this pain has a cauſe; but whether this cauſe is body or ſpirit, extended or unextended, figured or not figured, he cannot poſſibly, from any principles he is ſuppoſed to have, form the leaſt conjecture. Having had formerly no notion of body or of extenſion, the prick of a pin can give him none.

Suppoſe, next, a body not pointed, but blunt, is applied to his body with a force gradually increaſed until it bruiſes him. What has he got by this, but another ſenſation, or train of ſenſations, from which he is able to conclude as little as from the former? A ſchirrous tumour in any inward part of the body, by preſſing upon the adjacent parts, may give

give the ſame kind of ſenſation as the preſſure of an external body, without conveying any notion but that of pain, which ſurely hath no reſemblance to extenſion.

Suppoſe, thirdly, that the body applied to him touches a larger or a leſſer part of his body. Can this give him any notion of its extenſion or dimenſions? To me it ſeems impoſſible that it ſhould, unleſs he had ſome previous notion of the dimenſions and figure of his own body, to ſerve him as a meaſure. When my two hands touch the extremities of a body; if I know them to be a foot aſunder, I eaſily collect that the body is a foot long; and if I know them to be five feet aſunder, that it is five feet long: but if I know not what the diſtance of my hands is, I cannot know the length of the object they graſp; and if I have no previous notion of hands at all, or of diſtance between them, I can never get that notion by their being touched.

Suppoſe, again, that a body is drawn along his hands or face, while they are at reſt: Can this give him any notion of ſpace or motion? It no doubt gives a new feeling; but how it ſhould convey a notion of ſpace or motion, to one who had none before, I cannot conceive. The blood moves along the arteries and veins, and

and this motion, when violent, is felt: but I imagine no man, by this feeling, could get the conception of ſpace or motion, if he had it not before. Such a motion may give a certain ſucceſſion of feelings, as the colic may do; but no feelings, nor any combination of feelings, can ever reſemble ſpace or motion.

Let us next ſuppoſe, that he makes ſome inſtinctive effort to move his head or his hand; but that no motion follows, either on account of external reſiſtance, or of palſy. Can this effort convey the notion of ſpace and motion to one who never had it before? Surely it cannot.

Laſt of all, let us ſuppoſe, that he moves a limb by inſtinct, without having had any previous notion of ſpace or motion. He has here a new ſenſation, which accompanies the flexure of joints, and the ſwelling of muſcles. But how this ſenſation can convey into his mind the idea of ſpace and motion, is ſtill altogether myſterious and unintelligible. The motions of the heart and lungs are all performed by the contraction of muſcles, yet give no conception of ſpace or motion. An embryo in the womb has many ſuch motions, and probably the feelings that accompany them, without any idea of ſpace or motion.

Upon

Upon the whole, it appears, that our philoſophers have impoſed upon themſelves, and upon us, in pretending to deduce from ſenſation the firſt origin of our notions of external exiſtences, of ſpace, motion, and extenſion, and all the primary qualities of body, that is, the qualities whereof we have the moſt clear and diſtinct conception. Theſe qualities do not at all tally with any ſyſtem of the human faculties that hath been advanced. They have no reſemblance to any ſenſation, or to any operation of our minds; and therefore they cannot be ideas either of ſenſation, or of reflection. The very conception of them is irreconcilable to the principles of all our philoſophic ſyſtems of the underſtanding. The belief of them is no leſs ſo.

SECT. VII.

Of the exiſtence of a material world.

IT is beyond our power to ſay, when or in what order we came by our notions of theſe qualities. When we trace the operations of our minds as far back as memory and reflection can carry us, we find them already in poſſeſſion of our imagination and belief, and quite familiar to the mind: but how they came firſt into its acquaintance, or what has given them ſo ſtrong a hold of our belief, and what regard they deſerve, are no doubt very important queſtions in the philoſophy of human nature.

Shall we, with the Biſhop of Cloyne, ſerve them with a *Quo warranto*, and have them tried at the bar of philoſophy, upon the ſtatute of the ideal ſyſtem? Indeed, in this trial they ſeem to have come off very pitifully. For although they had very able counſel, learned in the law, *viz.* DES CARTES, MALEBRANCHE, and LOCKE, who ſaid every thing they could for their clients; the Biſhop of Cloyne,

Cloyne, believing them to be aiders and abetters of hereſy and ſchiſm, proſecuted them with great vigour, fully anſwered all that had been pleaded in their defence, and ſilenced their ableſt advocates, who ſeem for half a century paſt to decline the argument, and to truſt to the favour of the jury rather than to the ſtrength of their pleadings.

Thus, the wiſdom of *philoſophy* is ſet in oppoſition to the *common ſenſe* of mankind. The firſt pretends to demonſtrate *a priori*, that there can be no ſuch thing as a material world; that ſun, moon, ſtars, and earth, vegetable and animal bodies, are, and can be nothing elſe, but ſenſations in the mind, or images of thoſe ſenſations in the memory and imagination; that, like pain and joy, they can have no exiſtence when they are not thought of. The laſt can conceive no otherwiſe of this opinion, than as a kind of metaphyſical lunacy; and concludes, that too much learning is apt to make men mad; and that the man who ſeriouſly entertains this belief, though in other reſpects he may be a very good man, as a man may be who believes that he is made of glaſs; yet ſurely he hath a ſoft place in his underſtanding, and hath been hurt by much thinking.

This oppoſition betwixt philoſophy and common ſenſe, is apt to have a very unhappy influence upon the philoſopher himſelf. He ſees human nature in an odd, unamiable, and mortifying light. He conſiders himſelf, and the reſt of his ſpecies, as born under a neceſſity of believing ten thouſand abſurdities and contradictions, and endowed with ſuch a pittance of reaſon, as is juſt ſufficient to make this unhappy diſcovery: and this is all the fruit of his profound ſpeculations. Such notions of human nature tend to ſlacken every nerve of the ſoul, to put every noble purpoſe and ſentiment out of countenance, and ſpread a melancholy gloom over the whole face of things.

If this is wiſdom, let me be deluded with the vulgar. I find ſomething within me that recoils againſt it, and inſpires more reverent ſentiments of the human kind, and of the univerſal adminiſtration. Common ſenſe and reaſon have both one author; that Almighty author, in all whoſe other works we obſerve a conſiſtency, uniformity, and beauty, which charm and delight the underſtanding: there muſt therefore be ſome order and conſiſtency in the human faculties, as well as in other parts of his workmanſhip. A man that thinks reverently

reverently of his own kind, and eſteems true wiſdom and philoſophy, will not be fond, nay, will be very ſuſpicious, of ſuch ſtrange and paradoxical opinions. If they are falſe, they diſgrace philoſophy; and if they are true, they degrade the human ſpecies, and make us juſtly aſhamed of our frame.

To what purpoſe is it for philoſophy to decide againſt common ſenſe in this or any other matter? The belief of a material world is older, and of more authority, than any principles of philoſophy. It declines the tribunal of reaſon, and laughs at all the artillery of the logician. It retains its ſovereign authority in ſpite of all the edicts of philoſophy, and reaſon itſelf muſt ſtoop to its orders. Even thoſe philoſophers who have diſowned the authority of our notions of an external material world, confeſs, that they find themſelves under a neceſſity of ſubmitting to their power.

Methinks, therefore, it were better to make a virtue of neceſſity; and, ſince we cannot get rid of the vulgar notion and belief of an external world, to reconcile our reaſon to it as well as we can: for if Reaſon ſhould ſtomach and fret ever ſo much at this yoke, ſhe cannot throw it off; if ſhe will not be the

ſervant of Common Senſe, ſhe muſt be her ſlave.

In order, therefore, to reconcile reaſon to common ſenſe in this matter, I beg leave to offer to the conſideration of philoſophers theſe two obſervations. Firſt, That in all this debate about the exiſtence of a material world, it hath been taken for granted on both ſides, that this ſame material world, if any ſuch there be, muſt be the expreſs image of our ſenſations; that we can have no conception of any material thing which is not like ſome ſenſation in our minds; and particularly, that the ſenſations of touch are images of extenſion, hardneſs, figure, and motion. Every argument brought againſt the exiſtence of a material world, either by the Biſhop of Cloyne, or by the author of the *Treatiſe of Human Nature*, ſuppoſeth this. If this is true, their arguments are concluſive and unanſwerable: but, on the other hand, if it is not true, there is no ſhadow of argument left. Have thoſe philoſophers, then, given any ſolid proof of this hypotheſis, upon which the whole weight of ſo ſtrange a ſyſtem reſts? No. They have not ſo much as attempted to do it. But, becauſe ancient and modern philoſophers

ſophers have agreed in this opinion, they have taken it for granted. But let us, as becomes philoſophers, lay aſide authority; we need not ſurely conſult ARISTOTLE or LOCKE, to know whether pain be like the point of a ſword. I have as clear a conception of extenſion, hardneſs, and motion, as I have of the point of a ſword; and, with ſome pains and practice, I can form as clear a notion of the other ſenſations of touch, as I have of pain. When I do ſo, and compare them together, it appears to me clear as daylight, that the former are not of kin to the latter, nor reſemble them in any one feature. They are as unlike, yea as certainly and manifeſtly unlike, as pain is to the point of a ſword. It may be true, that thoſe ſenſations firſt introduced the material world to our acquaintance; it may be true, that it ſeldom or never appears without their company; but, for all that, they are as unlike as the paſſion of anger is to thoſe features of the countenance which attend it.

So that, in the ſentence thoſe philoſophers have paſſed againſt the material world, there is an *error perſonæ*. Their proof touches not matter, or any of its qualities; but ſtrikes directly againſt an idol of their own

imagination, a material world made of ideas and ſenſations, which never had nor can have an exiſtence.

Secondly, The very exiſtence of our conceptions of extenſion, figure, and motion, ſince they are neither ideas of ſenſation nor reflection, overturns the whole ideal ſyſtem, by which the material world hath been tried and condemned: ſo that there hath been likewiſe in this ſentence an *error juris*.

It is a very fine and a juſt obſervation of Locke, That as no human art can create a ſingle particle of matter, and the whole extent of our power over the material world, conſiſts in compounding, combining, and diſjoining, the matter made to our hands; ſo in the world of thought, the materials are all made by nature, and can only be variouſly combined and disjoined by us. So that it is impoſſible for reaſon or prejudice, true or falſe philoſophy, to produce one ſimple notion or conception, which is not the work of nature, and the reſult of our conſtitution. The conception of extenſion, motion, and the other attributes of matter, cannot be the effect of error or prejudice; it muſt be the work of nature. And the power or faculty, by which we acquire thoſe conceptions, muſt be

be ſomething different from any power of the human mind that hath been explained, ſince it is neither ſenſation nor reflection.

This I would therefore humbly propoſe, as an *experimentum crucis*, by which the ideal ſyſtem muſt ſtand or fall; and it brings the matter to a ſhort iſſue: Extenſion, figure, motion, may, any one, or all of them, be taken for the ſubject of this experiment. Either they are ideas of ſenſation, or they are not. If any one of them can be ſhewn to be an idea of ſenſation, or to have the leaſt reſemblance to any ſenſation, I lay my hand upon my mouth, and give up all pretence to reconcile reaſon to common ſenſe in this matter, and muſt ſuffer the ideal ſcepticiſm to triumph. But if, on the other hand, they are not ideas of ſenſation, nor like to any ſenſation, then the ideal ſyſtem is a rope of ſand, and all the laboured arguments of the ſceptical philoſophy againſt a material world, and againſt the exiſtence of every thing but impreſſions and ideas, proceed upon a falſe hypotheſis.

If our philoſophy concerning the mind be ſo lame with regard to the origin of our notions of the cleareſt, moſt ſimple, and moſt familiar objects of thought and the powers from

from which they are derived, can we expect that it ſhould be more perfect in the account it gives of the origin of our opinions and belief? We have ſeen already ſome inſtances of its imperfection in this reſpect: and perhaps that ſame nature which hath given us the power to conceive things altogether unlike to any of our ſenſations, or to any operation of our minds, hath likewiſe provided for our belief of them, by ſome part of our conſtitution hitherto not explained.

Biſhop BERKELEY hath proved, beyond the poſſibility of reply, that we cannot by reaſoning infer the exiſtence of matter from our ſenſations: and the author of the *Treatiſe of Human Nature* hath proved no leſs clearly, that we cannot by reaſoning infer the exiſtence of our own or other minds from our ſenſations. But are we to admit nothing but what can be proved by reaſoning? Then we muſt be ſceptics indeed, and believe nothing at all. The author of the *Treatiſe of Human Nature* appears to me to be but a half ſceptic. He hath not followed his principles ſo far as they lead him: but after having, with unparalleled intrepidity and ſucceſs, combated vulgar prejudices; when he had but one blow to ſtrike, his courage fails him, he fairly

ly lays down his arms, and yields himſelf a captive to the moſt common of all vulgar prejudices, I mean the belief of the exiſtence of his own impreſſions and ideas.

I beg, therefore, to have the honour of making an addition to the ſceptical ſyſtem, without which, I conceive, it cannot hang together. I affirm, that the belief of the exiſtence of impreſſions and ideas, is as little ſupported by reaſon, as that of the exiſtence of minds and bodies. No man ever did, or could offer any reaſon for this belief. DES CARTES took it for granted, that he thought, and had ſenſations and ideas; ſo have all his followers done. Even the hero of ſcepticiſm hath yielded this point, I crave leave to ſay, weakly and imprudently. I ſay ſo, becauſe I am perſuaded that there is no principle of his philoſophy that obliged him to make this conceſſion. And what is there in impreſſions and ideas ſo formidable, that this all-conquering philoſophy, after triumphing over every other exiſtence, ſhould pay homage to them? Beſides, the conceſſion is dangerous: for belief is of ſuch a nature, that if you leave any root, it will ſpread; and you may more eaſily pull it up altogether, than ſay, Hitherto ſhalt thou go, and no further: the exiſtence of im-

preſſions

preſſions and ideas I give up to thee; but ſee thou pretend to nothing more. A thorough and conſiſtent ſceptic will never, therefore, yield this point; and while he holds it, you can never oblige him to yield any thing elſe.

To ſuch a ſceptic I have nothing to ſay; but of the ſemi-ſceptics, I ſhould beg leave to know, why they believe the exiſtence of their impreſſions and ideas. The true reaſon I take to be, becauſe they cannot help it; and the ſame reaſon will lead them to believe many other things.

All reaſoning muſt be from firſt principles; and for firſt principles no other reaſon can be given but this, that, by the conſtitution of our nature, we are under a neceſſity of aſſenting to them. Such principles are parts of our conſtitution, no leſs than the power of thinking: reaſon can neither make nor deſtroy them; nor can it do any thing without them: it is like a teleſcope, which may help a man to ſee farther, who hath eyes; but without eyes, a teleſcope ſhews nothing at all. A mathematician cannot prove the truth of his axioms, nor can he prove any thing, unleſs he takes them for granted. We cannot prove the exiſtence of our minds, nor even of our thoughts

thoughts and ſenſations. A hiſtorian, or a witneſs, can prove nothing, unleſs it is taken for granted that the memory and ſenſes may be truſted. A natural philoſopher can prove nothing, unleſs it is taken for granted that the courſe of nature is ſteady and uniform.

How or when I got ſuch firſt principles, upon which I build all my reaſoning, I know not; for I had them before I can remember: but I am ſure they are parts of my conſtitution, and that I cannot throw them off. That our thoughts and ſenſations muſt have a ſubject, which we call *ourſelf*, is not therefore an opinion got by reaſoning, but a natural principle. That our ſenſations of touch indicate ſomething external, extended, figured, hard or ſoft, is not a deduction of reaſon, but a natural principle. The belief of it, and the very conception of it, are equally parts of our conſtitution. If we are deceived in it, we are deceived by Him that made us, and there is no remedy.

I do not mean to affirm, that the ſenſations of touch do from the very firſt ſuggeſt the ſame notions of body and its qualities, which they do when we are grown up. Perhaps nature is frugal in this, as in her other operations. The paſſion of love, with all its concomitant

concomitant ſentiments and deſires, is naturally ſuggeſted by the perception of beauty in the other ſex. Yet the ſame perception does not ſuggeſt the tender paſſion, till a certain period of life. A blow given to an infant, raiſes grief and lamentation; but when he grows up, it as naturally ſtirs reſentment, and prompts him to reſiſtance. Perhaps a child in the womb, or for ſome ſhort period of its exiſtence, is merely a ſentient being: the faculties, by which it perceives an external world, by which it reflects on its own thoughts, and exiſtence, and relation to other things, as well as its reaſoning and moral faculties, unfold themſelves by degrees; ſo that it is inſpired with the various principles of common ſenſe, as with the paſſions of love and reſentment, when it has occaſion for them.

SECT.

SECT. VIII.

Of the ſyſtems of philoſophers concerning the ſenſes.

ALL the ſyſtems of philoſophers about our ſenſes and their objects have ſplit upon this rock, of not diſtinguiſhing properly ſenſations, which can have no exiſtence but when they are felt, from the things ſuggeſted by them. ARISTOTLE, with as diſtinguiſhing a head as ever applied to philoſophical diſquiſitions, confounds theſe two; and makes every ſenſation to be the form, without the matter, of the thing perceived by it: As the impreſſion of a ſeal upon wax has the form of the ſeal, but nothing of the matter of it; ſo he conceived our ſenſations to be impreſſions upon the mind, which bear the image, likeneſs, or form of the external thing perceived, without the matter of it. Colour, ſound, and ſmell, as well as extenſion, figure, and hardneſs, are, according to him, various forms of matter: our ſenſations are the ſame forms imprinted

imprinted on the mind, and perceived in its own intellect. It is evident from this, that ARISTOTLE made no diſtinction between primary and ſecondary qualities of bodies, although that diſtinction was made by DEMOCRITUS, EPICURUS, and others of the ancients.

DES CARTES, MALEBRANCHE, and LOCKE, revived the diſtinction between primary and ſecondary qualities. But they made the ſecondary qualities mere ſenſations, and the primary ones reſemblances of our ſenſations. They maintained, that colour, ſound, and heat, are not any thing in bodies, but ſenſations of the mind: at the ſame time, they acknowledged ſome particular texture or modification of the body, to be the cauſe or occaſion of thoſe ſenſations; but to this modification they gave no name. Whereas, by the vulgar, the names of colour, heat, and ſound, are but rarely applied to the ſenſations, and moſt commonly to thoſe unknown cauſes of them; as hath been already explained. The conſtitution of our nature leads us rather to attend to the things ſignified by the ſenſation, than to the ſenſation itſelf, and to give a name to the former rather than to the latter. Thus we ſee, that with regard to ſecondary qualities,

qualities, theſe philoſophers thought with the vulgar, and with common ſenſe. Their paradoxes were only an abuſe of words. For when they maintain, as an important modern diſcovery, that there is no heat in the fire, they mean no more, than that the fire does not feel heat, which every one knew before.

With regard to primary qualities, theſe philoſophers erred more groſsly: They indeed believed the exiſtence of thoſe qualities; but they did not at all attend to the ſenſations that ſuggeſt them, which having no names, have been as little conſidered as if they had no exiſtence. They were aware, that figure, extenſion, and hardneſs, are perceived by means of ſenſations of touch; whence they raſhly concluded, that theſe ſenſations muſt be images and reſemblances of figure, extenſion, and hardneſs.

The received hypotheſis of ideas naturally led them to this concluſion; and indeed cannot conſiſt with any other; for, according to that hypotheſis, external things muſt be perceived by means of images of them in the mind; and what can thoſe images of external things in the mind be, but the ſenſations by which we perceive them?

This however was to draw a concluſion from a hypotheſis againſt fact. We need not have recourſe to any hypotheſis to know what our ſenſations are, or what they are like. By a proper degree of reflection and attention, we may underſtand them perfectly, and be as certain that they are not like any quality of body, as we can be, that the toothach is not like a triangle. How a ſenſation ſhould inſtantly make us conceive and believe the exiſtence of an external thing altogether unlike to it, I do not pretend to know; and when I ſay that the one ſuggeſts the other, I mean not to explain the manner of their connection, but to expreſs a fact, which every one may be conſcious of; namely, that, by a law of our nature, ſuch a conception and belief conſtantly and immediately follow the ſenſation.

Biſhop BERKELEY gave new light to this ſubject, by ſhowing, that the qualities of an inanimate thing, ſuch as matter is conceived to be, cannot reſemble any ſenſation; that it is impoſſible to conceive any thing like the ſenſations of our minds, but the ſenſations of other minds. Every one that attends properly to his ſenſations muſt aſſent to this; yet it had eſcaped all the philoſophers that came before BERKELEY; it had eſcaped even the ingenious

genious LOCKE, who had ſo much practiſed reflection on the operations of his own mind. So difficult it is to attend properly even to our own feelings. They are ſo accuſtomed to paſs through the mind unobſerved, and inſtantly to make way for that which nature intended them to ſignify, that it is extremely difficult to ſtop, and ſurvey them; and when we think we have acquired this power, perhaps the mind ſtill fluctuates between the ſenſation and its aſſociated quality, ſo that they mix together, and preſent ſomething to the imagination that is compounded of both. Thus in a globe or cylinder, whoſe oppoſite ſides are quite unlike in colour, if you turn it ſlowly, the colours are perfectly diſtinguiſhable, and their diſſimilitude is manifeſt; but if it is turned faſt, they loſe their diſtinction, and ſeem to be of one and the ſame colour.

No ſucceſſion can be more quick, than that of tangible qualities to the ſenſations with which nature has aſſociated them: But when one has once acquired the art of making them ſeparate and diſtinct objects of thought, he will then clearly perceive, that the maxim of Biſhop BERKELEY above mentioned, is ſelf-evident; and that the features of the face are

not more unlike to a paſſion of the mind which they indicate, than the ſenſations of touch are to the primary qualities of body.

But let us obſerve what uſe the Biſhop makes of this important diſcovery: Why, he concludes, that we can have no conception of an inanimate ſubſtance, ſuch as matter is conceived to be, or of any of its qualities; and that there is the ſtrongeſt ground to believe that there is no exiſtence in nature but minds, ſenſations, and ideas: If there is any other kind of exiſtences, it muſt be what we neither have nor can have any conception of. But how does this follow? Why thus: We can have no conception of any thing but what reſembles ſome ſenſation or idea in our minds; but the ſenſations and ideas in our minds can reſemble nothing but the ſenſations and ideas in other minds; therefore, the concluſion is evident. This argument, we ſee, leans upon two propoſitions. The laſt of them the ingenious author hath indeed made evident to all that underſtand his reaſoning, and can attend to their own ſenſations: but the firſt propoſition he never attempts to prove; it is taken from the doctrine of ideas, which hath

hath been ſo univerſally received by philoſophers, that it was thought to need no proof.

We may here again obſerve, that this acute writer argues from a hypotheſis againſt fact, and againſt the common ſenſe of mankind. That we can have no conception of any thing, unleſs there is ſome impreſſion, ſenſation, or idea, in our minds which reſembles it, is indeed an opinion which hath been very generally received among philoſophers; but it is neither ſelf-evident, nor hath it been clearly proved: and therefore it had been more reaſonable to call in queſtion this doctrine of philoſophers, than to diſcard the material world, and by that means expoſe philoſophy to the ridicule of all men, who will not offer up common ſenſe as a ſacrifice to metaphyſics.

We ought, however, to do this juſtice both to the Biſhop of Cloyne and to the author of the *Treatiſe of Human Nature*, to acknowledge, that their concluſions are juſtly drawn from the doctrine of ideas, which has been ſo univerſally received. On the other hand, from the character of Biſhop BERKELEY, and of his predeceſſors DES CARTES, LOCKE, and

MALEBRANCHE, we may venture to ſay, that if they had ſeen all the conſequences of this doctrine, as clearly as the author before mentioned did, they would have ſuſpected it vehemently, and examined it more carefully than they appear to have done.

The theory of ideas, like the Trojan horſe, had a ſpecious appearance both of innocence and beauty; but if thoſe philoſophers had known that it carried in its belly death and deſtruction to all ſcience and common ſenſe, they would not have broken down their walls to give it admittance.

That we have clear and diſtinct conceptions of extenſion, figure, motion, and other attributes of body, which are neither ſenſations, nor like any ſenſation, is a fact of which we may be as certain, as that we have ſenſations. And that all mankind have a fixed belief of an external material world, a belief which is neither got by reaſoning nor education, and a belief which we cannot ſhake off, even when we ſeem to have ſtrong arguments againſt it, and no ſhadow of argument for it, is likewiſe a fact, for which we have all the evidence that the nature of the thing admits. Theſe facts are phenomena of human nature,

ture, from which we may juſtly argue againſt any hypotheſis, however generally received. But to argue from a hypotheſis againſt facts, is contrary to the rules of true philoſophy.

CHAP. VI.

OF SEEING.

SECT. I.

The excellence and dignity of this faculty.

THE advances made in the knowledge of optics in the laſt age, and in the preſent, and chiefly the diſcoveries of Sir ISAAC NEWTON, do honour, not to philoſophy only, but to human nature. Such diſcoveries ought for ever to put to ſhame the ignoble attempts of our modern ſceptics to depreciate the human underſtanding, and to diſpirit men in the ſearch of truth, by repreſenting the human faculties as fit for nothing, but to lead us into abſurdities and contradictions.

Of the faculties called *the five ſenſes*, ſight is without doubt the nobleſt. The rays of light, which miniſter to this ſenſe, and of which,

which, without it, we could never have had the leaſt conception, are the moſt wonderful and aſtoniſhing part of the inanimate creation. We muſt be ſatisfied of this, if we conſider their extreme minuteneſs, their inconceivable velocity, the regular variety of colours which they exhibit, the invariable laws according to which they are acted upon by other bodies, in their reflections, inflections, and refractions, without the leaſt change of their original properties, and the facility with which they pervade bodies of great denſity, and of the cloſeſt texture, without reſiſtance, without crowding or diſturbing one another, without giving the leaſt ſenſible impulſe to the lighteſt bodies.

The ſtructure of the eye, and of all its appurtenances, the admirable contrivances of nature for performing all its various external and internal motions, and the variety in the eyes of different animals, ſuited to their ſeveral natures and ways of life, clearly demonſtrate this organ to be a maſterpiece of Nature's work. And he muſt be very ignorant of what hath been diſcovered about it, or have a very ſtrange caſt of underſtanding, who can ſeriouſly doubt, whether or not the rays of light and the eye were made for one another,

another, with conſummate wiſdom, and perfect ſkill in optics.

If we ſhall ſuppoſe an order of beings, endued with every human faculty but that of ſight, how incredible would it appear to ſuch beings, accuſtomed only to the ſlow informations of touch, that, by the addition of an organ, conſiſting of a ball and ſocket of an inch diameter, they might be enabled in an inſtant of time, without changing their place, to perceive the diſpoſition of a whole army, or the order of a battle, the figure of a magnificent palace, or all the variety of a landſcape? If a man were by feeling to find out the figure of the peak of Teneriffe, or even of St Peter's Church at Rome, it would be the work of a lifetime.

It would appear ſtill more incredible to ſuch beings as we have ſuppoſed, if they were informed of the diſcoveries which may be made by this little organ in things far beyond the reach of any other ſenſe: That by means of it we can find our way in the pathleſs ocean; that we can traverſe the globe of the earth, determine its figure and dimenſions, and delineate every region of it: Yea, that we can meaſure the planetary orbs, and make diſcoveries in the ſphere of the fixed ſtars.

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Would it not appear ſtill more aſtoniſhing to ſuch beings, if they ſhould be further informed, That, by means of this ſame organ, we can perceive the tempers and diſpoſitions, the paſſions and affections of our fellow-creatures, even when they want moſt to conceal them? That when the tongue is taught moſt artfully to lie and diſſemble, the hypocriſy ſhould appear in the countenance to a diſcerning eye? And that by this organ, we can often perceive what is ſtraight and what is crooked in the mind as well as in the body? —How many myſterious things muſt a blind man believe, if he will give credit to the relations of thoſe that ſee? Surely he needs as ſtrong a faith as is required of a good Chriſtian.

It is not therefore without reaſon, that the faculty of ſeeing is looked upon, not only as more noble than the other ſenſes, but as having ſomething in it of a nature ſuperior to ſenſation. The evidence of reaſon is called *ſeeing*, not *feeling*, *ſmelling*, or *taſting*. Yea, we are wont to expreſs the manner of the divine knowledge by *ſeeing*, as that kind of knowledge which is moſt perfect in us.

SECT.

SECT. II.

Sight diſcovers almoſt nothing which the blind may not comprehend. The reaſon of this.

NOTWITHSTANDING what hath been ſaid of the dignity and ſuperior nature of this faculty, it is worthy of our obſervation, that there is very little of the knowledge acquired by ſight, that may not be communicated to a man born blind. One who never ſaw the light, may be learned and knowing in every ſcience, even in optics; and may make diſcoveries in every branch of philoſophy. He may underſtand as much as another man, not only of the order, diſtances, and motions of the heavenly bodies; but of the nature of light, and of the laws of the reflection and refraction of its rays. He may underſtand diſtinctly, how thoſe laws produce the phenomena of the rain-bow, the priſm, the camera obſcura, and the magic lanthorn, and all the powers of the microſcope and teleſcope. This is a fact ſufficiently atteſted by experience.

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In order to perceive the reaſon of it, we muſt diſtinguiſh the appearance that objects make to the eye, from the things ſuggeſted by that appearance: and again, in the viſible appearance of objects, we muſt diſtinguiſh the appearance of colour from the appearance of extenſion, figure, and motion. Firſt, then, as to the viſible appearance of the figure, and motion, and extenſion of bodies, I conceive that a man born blind may have a diſtinct notion, if not of the very things, at leaſt of ſomething extremely like to them. May not a blind man be made to conceive, that a body moving directly from the eye, or directly towards it, may appear to be at reſt? and that the ſame motion may appear quicker or ſlower, according as it is nearer to the eye or farther off, more direct or more oblique? May he not be made to conceive, that a plain ſurface, in a certain poſition, may appear as a ſtraight line, and vary its viſible figure, as its poſition, or the poſition of the eye, is varied? That a circle ſeen obliquely will appear an ellipſe; and a ſquare, a rhombus, or an oblong rectangle? Dr SAUNDERSON underſtood the projection of the ſphere, and the common rules of perſpective; and if he did, he muſt have underſtood all that I have mentioned.

If

If there were any doubt of Dr SAUNDERSON's underſtanding theſe things, I could mention my having heard him ſay in converſation, that he found great difficulty in underſtanding Dr HALLEY's demonſtration of that propoſition, That the angles made by the circles of the ſphere, are equal to the angles made by their repreſentatives in the ſtereographic projection: But, ſaid he, when I laid aſide that demonſtration, and conſidered the propoſition in my own way, I ſaw clearly that it muſt be true. Another gentleman, of undoubted credit and judgment in theſe matters, who had part in this converſation, remembers it diſtinctly.

As to the appearance of colour, a blind man muſt be more at a loſs; becauſe he hath no perception that reſembles it. Yet he may, by a kind of analogy, in part ſupply this defect. To thoſe who ſee, a ſcarlet colour ſignifies an unknown quality in bodies, that makes to the eye an appearance, which they are well acquainted with, and have often obſerved: to a blind man, it ſignifies an unknown quality that makes to the eye an appearance, which he is unacquainted with. But he can conceive the eye to be variouſly affected by different colours, as the noſe is by different ſmells,

ſmells, or the ear by different ſounds. Thus he can conceive ſcarlet to differ from blue, as the ſound of a trumpet does from that of a drum; or as the ſmell of an orange differs from that of an apple. It is impoſſible to know whether a ſcarlet colour has the ſame appearance to me which it hath to another man; and if the appearances of it to different perſons differed as much as colour does from ſound, they might never be able to diſcover this difference. Hence it appears obvious, that a blind man might talk long about colours diſtinctly and pertinently: and if you were to examine him in the dark about the nature, compoſition, and beauty of them, he might be able to anſwer, ſo as not to betray his defect.

We have ſeen how far a blind man may go in the knowledge of the appearances which things make to the eye. As to the things which are ſuggeſted by them, or inferred from them; although he could never diſcover them of himſelf, yet he may underſtand them perfectly by the information of others. And every thing of this kind that enters into our minds by the eye, may enter into his by the ear. Thus, for inſtance, he could never, if left to the direction of his own faculties, have dreamed

dreamed of any ſuch thing as light; but he can be informed of every thing we know about it. He can conceive, as diſtinctly as we, the minuteneſs and velocity of its rays, their various degrees of refrangibility and reflexibility, and all the magical powers and virtues of that wonderful element. He could never of himſelf have found out, that there are ſuch bodies as the ſun, moon, and ſtars; but he may be informed of all the noble diſcoveries of aſtronomers about their motions, and the laws of nature by which they are regulated. Thus it appears, that there is very little knowledge got by the eye, which may not be communicated by language to thoſe who have no eyes.

If we ſhould ſuppoſe, that it were as uncommon for men to ſee, as it is to be born blind; would not the few who had this rare gift, appear as prophets and inſpired teachers to the many? We conceive inſpiration to give a man no new faculty, but to communicate to him in a new way, and by extraordinary means, what the faculties common to mankind can apprehend, and what he can communicate to others by ordinary means. On the ſuppoſition we have made, ſight would appear to the blind very ſimiliar to this; for the

the few who had this gift, could communicate the knowledge acquired by it to thoſe who had it not. They could not indeed convey to the blind any diſtinct notion of the manner in which they acquired this knowledge. A ball and ſocket would ſeem, to a blind man, in this caſe, as improper an inſtrument for acquiring ſuch a variety and extent of knowledge, as a dream or a viſion. The manner in which a man who ſees, diſcerns ſo many things by means of the eye, is as unintelligible to the blind, as the manner in which a man may be inſpired with knowledge by the Almighty, is to us. Ought the blind man, therefore, without examination, to treat all pretences to the gift of ſeeing as impoſture? Might he not, if he were candid and tractable, find reaſonable evidence of the reality of this gift in others, and draw great advantages from it to himſelf?

The diſtinction we have made between the viſible appearances of the objects of ſight, and things ſuggeſted by them, is neceſſary to give us a juſt notion of the intention of nature in giving us eyes. If we attend duly to the operation of our mind in the uſe of this faculty, we ſhall perceive, that the viſible appearance of objects is hardly ever regarded by us.

It is not at all made an object of thought or reflection, but ſerves only as a ſign to introduce to the mind ſomething elſe, which may be diſtinctly conceived by thoſe who never ſaw.

Thus, the viſible appearance of things in my room varies almoſt every hour, according as the day is clear or cloudy, as the ſun is in the eaſt, or ſouth, or weſt, and as my eye is in one part of the room or in another: but I never think of theſe variations, otherwiſe than as ſigns of morning, noon, or night, of a clear or cloudy ſky. A book or a chair has a different appearance to the eye, in every different diſtance and poſition; yet we conceive it to be ſtill the ſame; and, overlooking the appearance, we immediately conceive the real figure, diſtance, and poſition of the body, of which its viſible or perſpective appearance is a ſign and indication.

When I ſee a man at the diſtance of ten yards, and afterwards ſee him at the diſtance of a hundred yards, his viſible appearance in its length, breadth, and all its linear proportions, is ten times leſs in the laſt caſe than it is in the firſt: yet I do not conceive him one inch diminiſhed by this diminution of his viſible figure. Nay, I do not in the leaſt attend to this diminution, even when I draw from it

the

the concluſion of his being at a greater diſtance. For ſuch is the ſubtilty of the mind's operation in this caſe, that we draw the concluſion, without perceiving that ever the premiſes entered into the mind. A thouſand ſuch inſtances might be produced, in order to ſhew that the viſible appearances of objects are intended by nature only as ſigns or indications; and that the mind paſſes inſtantly to the things ſignified, without making the leaſt reflection upon the ſign, or even perceiving that there is any ſuch thing. It is in a way ſomewhat ſimilar, that the ſounds of a language, after it is become familiar, are overlooked, and we attend only to the things ſignified by them.

It is therefore a juſt and important obſervation of the Biſhop of Cloyne, That the viſible appearance of objects is a kind of language uſed by nature, to inform us of their diſtance, magnitude, and figure. And this obſervation hath been very happily applied by that ingenious writer, to the ſolution of ſome phenomena in optics, which had before perplexed the greateſt maſters in that ſcience. The ſame obſervation is further improved by the judicious Dr SMYTH, in his Optics, for explaining the apparent figure of the heavens,

and the apparent diſtances and magnitudes of objects ſeen with glaſſes, or by the naked eye.

Avoiding as much as poſſible the repetition of what hath been ſaid by theſe excellent writers, we ſhall avail ourſelves of the diſtinction between the ſigns that nature uſeth in this viſual language, and the things ſignified by them; and in what remains to be ſaid of ſight, ſhall firſt make ſome obſervations upon the ſigns.

SECT. III.

Of the viſible appearances of objects.

IN this ſection we muſt ſpeak of things which are never made the object of reflection, though almoſt every moment preſented to the mind. Nature intended them only for ſigns; and in the whole courſe of life they are put to no other uſe. The mind has acquired a confirmed and inveterate habit of inattention to them; for they no ſooner appear, than quick as lightning the thing ſignified ſucceeds, and engroſſes all our regard. They have no name in language; and although we are conſcious of them when they

paſs

paſs through the mind, yet their paſſage is ſo quick, and ſo familiar, that it is abſolutely unheeded; nor do they leave any footſteps of themſelves, either in the memory or imagination. That this is the caſe with regard to the ſenſations of touch, hath been ſhown in the laſt chapter; and it holds no leſs with regard to the viſible appearances of objects.

I cannot therefore entertain the hope of being intelligible to thoſe readers who have not, by pains and practice, acquired the habit of diſtinguiſhing the appearance of objects to the eye, from the judgment which we form by ſight, of their colour, diſtance, magnitude, and figure. The only profeſſion in life wherein it is neceſſary to make this diſtinction, is that of painting. The painter hath occaſion for an abſtraction, with regard to viſible objects, ſomewhat ſimilar to that which we here require: and this indeed is the moſt difficult part of his art. For it is evident, that if he could fix in his imagination the viſible appearance of objects, without confounding it with the things ſignified by that appearance, it would be as eaſy for him to paint from the life, and to give every figure its proper ſhading and relief, and its perſpective proportions, as it is to paint from a copy. Perſpec-

tive, ſhading, giving relief, and colouring, are nothing elſe but copying the appearance which things make to the eye. We may therefore borrow ſome light on the ſubject of viſible appearance from this art.

Let one look upon any familiar object, ſuch as a book, at different diſtances and in different poſitions: is he not able to affirm, upon the teſtimony of his ſight, that it is the ſame book, the ſame object, whether ſeen at the diſtance of one foot or of ten, whether in one poſition or another; that the colour is the ſame, the dimenſions the ſame, and the figure the ſame, as far as the eye can judge? This ſurely muſt be acknowledged. The ſame individual object is preſented to the mind, only placed at different diſtances, and in different poſitions. Let me aſk, in the next place, Whether this object has the ſame appearance to the eye in theſe different diſtances? Infallibly it hath not. For,

Firſt, However certain our judgment may be that the colour is the ſame, it is as certain that it hath not the ſame appearance at different diſtances. There is a certain degradation of the colour, and a certain confuſion and indiſtinctneſs of the minute parts, which is the natural conſequence of the removal of the object

object to a greater diſtance. Thoſe that are not painters, or critics in painting, overlook this; and cannot eaſily be perſuaded, that the colour of the ſame object hath a different appearance at the diſtance of one foot and of ten, in the ſhade and in the light. But the maſters in painting know how, by the degradation of the colour, and the confuſion of the minute parts, figures, which are upon the ſame canvas, and at the ſame diſtance from the eye, may be made to repreſent objects which are at the moſt unequal diſtances. They know how to make the objects appear to be of the ſame colour, by making their pictures really of different colours, according to their diſtances or ſhades.

Secondly, Every one who is acquainted with the rules of perſpective, knows that the appearance of the figure of the book muſt vary in every different poſition: yet if you aſk a man that has no notion of perſpective, whether the figure of it does not appear to his eye to be the ſame in all its different poſitions? he can with a good conſcience affirm, that it does. He hath learned to make allowance for the variety of viſible figure ariſing from the difference of poſition, and to draw the proper concluſions from it. But he draws theſe con-

cluſions ſo readily and habitually, as to loſe ſight of the premiſes; and, therefore, where he hath made the ſame concluſion, he conceives the viſible appearance muſt have been the ſame.

Thirdly, Let us conſider the apparent magnitude or dimenſions of the book. Whether I view it at the diſtance of one foot or of ten feet, it ſeems to be about ſeven inches long, five broad, and one thick. I can judge of theſe dimenſions very nearly by the eye, and I judge them to be the ſame at both diſtances. But yet it is certain, that at the diſtance of one foot, its viſible length and breadth is about ten times as great as at the diſtance of ten feet; and conſequently its ſurface is about a hundred times as great. This great change of apparent magnitude is altogether overlooked, and every man is apt to imagine, that it appears to the eye of the ſame ſize at both diſtances. Further, when I look at the book, it ſeems plainly to have three dimenſions, of length, breadth, and thickneſs: but it is certain that the viſible appearance hath no more than two, and can be exactly repreſented upon a canvas which hath only length and breadth.

In the laſt place, Does not every man, by ſight,

ſight, perceive the diſtance of the book from his eye? Can he not affirm with certainty, that in one caſe it is not above one foot diſtant, that in another it is ten? Nevertheleſs it appears certain, that diſtance from the eye, is no immediate object of ſight. There are certain things in the viſible appearance, which are ſigns of diſtance from the eye, and from which, as we ſhall afterwards ſhow, we learn by experience to judge of that diſtance within certain limits; but it ſeems beyond doubt, that a man born blind, and ſuddenly made to ſee, could form no judgment at firſt of the diſtance of the objects which he ſaw. The young man couched by CHESELDON, thought, at firſt, that every thing he ſaw touched his eye, and learned only by experience to judge of the diſtance of viſible objects.

I have entered into this long detail, in order to ſhew, that the viſible appearance of an object is extremely different from the notion of it which experience teaches us to form by ſight; and to enable the reader to attend to the viſible appearance of colour, figure, and extenſion, in viſible things, which is no common object of thought, but muſt be carefully attended to by thoſe who would enter into the philoſophy of this ſenſe, or would comprehend what

what ſhall be ſaid upon it. To a man newly made to ſee, the viſible appearance of objects would be the ſame as to us; but he would ſee nothing at all of their real dimenſions, as we do. He could form no conjecture, by means of his ſight only, how many inches or feet they were in length, breadth, or thickneſs. He could perceive little or nothing of their real figure; nor could he diſcern that this was a cube, that a ſphere; that this was a cone, and that a cylinder. His eye could not inform him, that this object was near, and that more remote. The habit of a man or of a woman, which appeared to us of one uniform colour, variouſly folded and ſhaded, would preſent to his eye neither fold nor ſhade, but variety of colour. In a word, his eyes, though ever ſo perfect, would at firſt give him almoſt no information of things without him. They would indeed preſent the ſame appearances to him as they do to us, and ſpeak the ſame language; but to him it is an unknown language; and therefore he would attend only to the ſigns, without knowing the ſignification of them: whereas to us it is a language perfectly familiar; and therefore we take no notice of the ſigns, but attend only to the thing ſignified by them.

SECT.

SECT. IV.

That colour is a quality of bodies, not a ſenſation of the mind.

BY colour, all men, who have not been tutored by modern philoſophy, underſtand, not a ſenſation of the mind, which can have no exiſtence when it is not perceived, but a quality or modification of bodies, which continues to be the ſame, whether it is ſeen or not. The ſcarlet-roſe, which is before me, is ſtill a ſcarlet-roſe when I ſhut my eyes, and was ſo at midnight when no eye ſaw it. The colour remains when the appearance ceaſes: it remains the ſame when the appearance changes. For when I view this ſcarlet-roſe through a pair of green ſpectacles, the appearance is changed, but I do not conceive the colour of the roſe changed. To a perſon in the jaundice, it has ſtill another appearance; but he is eaſily convinced, that the change is in his eye, and not in the colour of the object. Every different degree of light makes it have a different appearance, and total darkneſs takes away

away all appearance, but makes not the leaſt change in the colour of the body. We may, by a variety of optical experiments, change the appearance of figure and magnitude in a body, as well as that of colour; we may make one body appear to be ten. But all men believe, that as a multiplying glaſs does not really produce ten guineas out of one, nor a microſcope turn a guinea into a ten pound piece; ſo neither does a coloured glaſs change the real colour of the object ſeen through it, when it changes the appearance of that colour.

The common language of mankind ſhows evidently, that we ought to diſtinguiſh between the colour of a body, which is conceived to be a fixed and permanent quality in the body, and the appearance of that colour to the eye, which may be varied a thouſand ways, by a variation of the light, of the medium, or of the eye itſelf. The permanent colour of the body is the cauſe, which, by the mediation of various kinds or degrees of light, and of various tranſparent bodies interpoſed, produces all this variety of appearances. When a coloured body is preſented, there is a certain apparition to the eye, or to the mind, which we have called *the appear-*

ance of colour. Mr LOCKE calls it *an idea;* and indeed it may be called ſo with the greateſt propriety. This idea can have no exiſtence but when it is perceived. It is a kind of thought, and can only be the act of a percipient or thinking being. By the conſtitution of our nature, we are led to conceive this idea as a ſign of ſomething external, and are impatient till we learn its meaning. A thouſand experiments for this purpoſe are made every day by children, even before they come to the uſe of reaſon. They look at things, they handle them, they put them in various poſitions, at different diſtances, and in different lights. The ideas of ſight, by theſe means, come to be aſſociated with, and readily to ſuggeſt, things external, and altogether unlike them. In particular, that idea which we have *called the appearance of colour*, ſuggeſts the conception and belief of ſome unknown quality in the body, which occaſions the idea; and it is to this quality, and not to the idea, that we give the name of *colour.* The various colours, although in their nature equally unknown, are eaſily diſtinguiſhed when we think or ſpeak of them, by being aſſociated with the ideas which they excite. In like manner, gravity, magnetiſm, and electricity, although

although all unknown qualities, are diſtinguiſhed by their different effects. As we grow up, the mind acquires a habit of paſſing ſo rapidly from the ideas of ſight to the external things ſuggeſted by them, that the ideas are not in the leaſt attended to, nor have they names given them in common language.

When we think or ſpeak of any particular colour, however ſimple the notion may ſeem to be, which is preſented to the imagination, it is really in ſome ſort compounded. It involves an unknown cauſe, and a known effect. The name of *colour* belongs indeed to the cauſe only, and not to the effect. But as the cauſe is unknown, we can form no diſtinct conception of it, but by its relation to the known effect. And therefore both go together in the imagination, and are ſo cloſely united, that they are miſtaken for one ſimple object of thought. When I would conceive thoſe colours of bodies which we call *ſcarlet* and *blue*; if I conceived them only as unknown qualities, I could perceive no diſtinction between the one and the other. I muſt therefore, for the ſake of diſtinction, join to each of them, in my imagination, ſome effect or ſome relation that is peculiar. And the moſt obvious diſtinction is, the appearance which one and the other makes to the eye.

eye. Hence the appearance is, in the imagination, ſo cloſely united with the quality called *a ſcarlet-colour*, that they are apt to be miſtaken for one and the ſame thing, although they are in reality ſo different and ſo unlike, that one is an idea in the mind, the other is a quality of body.

I conclude, then, that colour is not a ſenſation, but a ſecondary quality of bodies, in the ſenſe we have already explained; that it is a certain power or virtue in bodies, that in fair daylight exhibits to the eye an appearance, which is very familiar to us, although it hath no name. Colour differs from other ſecondary qualities in this, that whereas the name of the quality is ſometimes given to the ſenſation which indicates it, and is occaſioned by it, we never, as far as I can judge, give the name of *colour* to the ſenſation, but to the quality only. Perhaps the reaſon of this may be, that the appearances of the ſame colour are ſo various and changeable, according to the different modifications of the light, of the medium, and of the eye, that language could not afford names for them. And indeed they are ſo little intereſting, that they are never attended to, but ſerve only as ſigns to introduce the things ſignified by them. Nor ought

ought it to appear incredible, that appearances ſo frequent and ſo familiar ſhould have no names, nor be made objects of thought; ſince we have before ſhown, that this is true of many ſenſations of touch, which are no leſs frequent, nor leſs familiar.

SECT. V.

An inference from the preceding.

FROM what hath been ſaid about colour, we may infer two things. The firſt is, that one of the moſt remarkable paradoxes of modern philoſophy, which hath been univerſally eſteemed as a great diſcovery, is, in reality, when examined to the bottom, nothing elſe but an abuſe of words. The paradox I mean is, That colour is not a quality of bodies, but only an idea in the mind. We have ſhown, that the word *colour*, as uſed by the vulgar, cannot ſignify an idea in the mind, but a permanent quality of body. We have ſhown, that there is really a permanent quality of body, to which the common uſe of this word exactly agrees. Can any ſtronger proof be

be deſired, that this quality is that to which the vulgar give the name of *colour?* If it ſhould be ſaid, that this quality, to which we give the name of *colour*, is unknown to the vulgar, and therefore can have no name among them; I anſwer, it is indeed known only by its effects; that is, by its exciting a certain idea in us: but are there not numberleſs qualities of bodies, which are known only by their effects, to which, notwithſtanding, we find it neceſſary to give names? Medicine alone might furniſh us with a hundred inſtances of this kind. Do not the words *aſtringent*, *narcotic*, *epiſpaſtic*, *cauſtic*, and innumerable others, ſignify qualities of bodies, which are known only by their effects upon animal bodies? Why then ſhould not the vulgar give a name to a quality, whoſe effects are every moment perceived by their eyes? We have all the reaſon, therefore, that the nature of the thing admits, to think that the vulgar apply the name of *colour* to that quality of bodies, which excites in us what the philoſophers call the *idea of colour*. And that there is ſuch a quality in bodies, all philoſophers allow, who allow that there is any ſuch thing as body. Philoſophers have thought fit to leave that quality of bodies, which the vul-

gar call *colour*, without a name, and to give the name of *colour* to the idea or appearance, to which, as we have ſhown, the vulgar give no name, becauſe they never make it an object of thought or reflection. Hence it appears, that when philoſophers affirm that colour is not in bodies, but in the mind; and the vulgar affirm, that colour is not in the mind, but is a quality of bodies; there is no difference between them about things, but only about the meaning of a word.

The vulgar have undoubted right to give names to things which they are daily converſant about; and philoſophers ſeem juſtly chargeable with an abuſe of language, when they change the meaning of a common word, without giving warning.

If it is a good rule, to think with philoſophers, and ſpeak with the vulgar, it muſt be right to ſpeak with the vulgar, when we think with them, and not to ſhock them by philoſophical paradoxes, which, when put into common language, expreſs only the common ſenſe of mankind.

If you aſk a man, that is no philoſopher, what colour is? or, what makes one body appear white, another ſcarlet? He cannot tell. He leaves that inquiry to philoſophers, and can

can embrace any hypotheſis about it, except that of our modern philoſophers, who affirm, that colour is not in body, but only in the mind.

Nothing appears more ſhocking to his apprehenſion, than that viſible objects ſhould have no colour, and that colour ſhould be in that which he conceives to be inviſible. Yet this ſtrange paradox is not only univerſally received, but conſidered as one of the nobleſt diſcoveries of modern philoſophy. The ingenious ADDISON, in the Spectator, N° 413., ſpeaks thus of it. "I have here ſuppoſed, "that my reader is acquainted with that great "modern diſcovery, which is at preſent uni- "verſally acknowledged by all the inquirers "into natural philoſophy, namely, that light "and colours, as apprehended by the imagi- "nation, are only ideas in the mind, and not "qualities that have any exiſtence in matter. "As this is a truth, which has been proved "inconteſtably by many modern philoſophers, "and is indeed one of the fineſt ſpeculations "in that ſcience, if the Engliſh reader would "ſee the notion explained at large, he may "find it in the eighth chapter of the ſecond "book of LOCKE's *Eſſay on Human Under-"ſtanding*."

Mr LOCKE and Mr ADDISON are writers who have deſerved ſo well of mankind, that one muſt feel ſome uneaſineſs in differing from them, and would wiſh to aſcribe all the merit that is due to a diſcovery upon which they put ſo high a value. And indeed it is juſt to acknowledge, that LOCKE, and other modern philoſophers on the ſubject of ſecondary qualities, have the merit of diſtinguiſhing more accurately than thoſe that went before them, between the ſenſation in the mind, and that conſtitution or quality of bodies which gives occaſion to the ſenſation. They have ſhown clearly, that theſe two things are not only diſtinct, but altogether unlike: that there is no ſimilitude between the effluvia of an odorous body, and the ſenſation of ſmell, or between the vibrations of a ſounding body, and the ſenſation of ſound: that there can be no reſemblance between the feeling of heat, and the conſtitution of the heated body which occaſions it; or between the appearance which a coloured body makes to the eye, and the texture of the body which cauſes that appearance.

Nor was the merit ſmall of diſtinguiſhing theſe things accurately; becauſe, however different and unlike in their nature, they have been

been always so associated in the imagination, as to coalesce as it were into one two-faced form, which, from its amphibious nature, could not justly be appropriated either to body or mind; and, until it was properly distinguished into its different constituent parts, it was impossible to assign to either their just shares in it. None of the ancient philosophers had made this distinction. The followers of DEMOCRITUS and EPICURUS conceived the forms of heat, and sound, and colour, to be in the mind only, but that our senses fallaciously represented them as being in bodies. The Peripatetics imagined, that those forms are really in bodies; and that the images of them are conveyed to the mind by our senses.

The one system made the senses naturally fallacious and deceitful; the other made the qualities of body to resemble the sensations of the mind. Nor was it possible to find a third, without making the distinction we have mentioned; by which indeed the errors of both these ancient systems are avoided, and we are not left under the hard necessity of believing, either, on the one hand, that our sensations are like to the qualities of body, or, on the other, that GOD hath given us one fa-

culty to deceive us, and another to detect the cheat.

We desire, therefore, with pleasure, to do justice to the doctrine of LOCKE, and other modern philosophers, with regard to colour, and other secondary qualities, and to ascribe to it its due merit, while we beg leave to censure the language in which they have expressed their doctrine. When they had explained and established the distinction between the appearance which colour makes to the eye, and the modification of the coloured body, which, by the laws of Nature, causes that appearance; the question was, Whether to give the name of *colour* to the cause, or to the effect? By giving it, as they have done, to the effect, they set philosophy apparently in opposition to common sense, and expose it to the ridicule of the vulgar. But, had they given the name of *colour* to the cause, as they ought to have done, they must then have affirmed, with the vulgar, that colour is a quality of bodies; and that there is neither colour, nor any thing like it, in the mind. Their language, as well as their sentiments, would have been perfectly agreeable to the common apprehensions of mankind, and true philosophy would have joined hands with Common Sense.

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As LOCKE was no enemy to common ſenſe, it may be preſumed, that, in this inſtance, as in ſome others, he was ſeduced by ſome received hypotheſis: and, that this was actually the caſe, will appear in the following ſection.

SECT. VI.

That none of our ſenſations are reſemblances of any of the qualities of bodies.

A SECOND inference is, That although colour is really a quality of body, yet it is not repreſented to the mind by an idea or ſenſation that reſembles it; on the contrary, it is ſuggeſted by an idea which does not in the leaſt reſemble it. And this inference is applicable, not to colour only, but to all the qualities of body which we have examined.

It deſerves to be remarked, that, in the analyſis we have hitherto given of the operations of the five ſenſes, and of the qualities of bodies diſcovered by them, no inſtance hath occurred, either of any ſenſation which reſembles any quality of body, or of any quality of body whoſe image or reſemblance is conveyed to the mind by means of the ſenſes.

There is no phenomenon in nature more unaccountable, than the intercourſe that is carried on between the mind and the external world: there is no phenomenon which philoſophical ſpirits have ſhown greater avidity to pry into and to reſolve. It is agreed by all, that this intercourſe is carried on by means of the ſenſes: and this ſatisfies the vulgar curioſity, but not the philoſophic. Philoſophers muſt have ſome ſyſtem, ſome hypotheſis, that ſhews the manner in which our ſenſes make us acquainted with external things. All the fertility of human invention ſeems to have produced only one hypotheſis for this purpoſe, which therefore hath been univerſally received; and that is, that the mind, like a mirror, receives the images of things from without, by means of the ſenſes; ſo that their uſe muſt be to convey theſe images into the mind.

Whether to theſe images of external things in the mind, we give the name of *ſenſible forms*, or *ſenſible ſpecies*, with the Peripatetics, or the name *of ideas of ſenſation*, with LOCKE; or whether, with later philoſophers, we diſtinguiſh *ſenſations*, which are immediately conveyed by the ſenſes, from *ideas of ſenſation*, which are faint copies of our ſenſations retained

retained in the memory and imagination; theſe are only differences about words. The hypotheſis I have mentioned is common to all theſe different ſyſtems.

The neceſſary and allowed conſequence of this hypotheſis is, That no material thing, nor any quality of material things, can be conceived by us, or made an object of thought, until its image is conveyed to the mind by means of the ſenſes. We ſhall examine this hypotheſis particularly afterwards, and at this time only obſerve, that, in conſequence of it, one would naturally expect, that to every quality and attribute of body we know or can conceive, there ſhould be a ſenſation correſponding, which is the image and reſemblance of that quality; and that the ſenſations which have no ſimilitude or reſemblance to body, or to any of its qualities, ſhould give us no conception of a material world, or of any thing belonging to it. Theſe things might be expected as the natural conſequences of the hypotheſis we have mentioned.

Now, we have conſidered, in this and the preceding chapters, extenſion, figure, ſolidity, motion, hardneſs, roughneſs, as well as colour, heat and cold, ſound, taſte, and ſmell. We have endeavoured to ſhew, that our nature and

and conſtitution lead us to conceive theſe as qualities of body, as all mankind have always conceived them to be. We have likewiſe examined, with great attention, the various ſenſations we have by means of the five ſenſes, and are not able to find among them all, one ſingle image of body, or of any of its qualities. From whence then come thoſe images of body and of its qualities into the mind? Let philoſophers reſolve this queſtion. All I can ſay is, that they come not by the ſenſes. I am ſure, that, by proper attention and care, I may know my ſenſations, and be able to affirm with certainty what they reſemble, and what they do not reſemble. I have examined them one by one, and compared them with matter and its qualities; and I cannot find one of them that confeſſes a reſembling feature.

A truth ſo evident as this, That our ſenſations are not images of matter, or of any of its qualities, ought not to yield to a hypotheſis ſuch as that above mentioned, however ancient, or however univerſally received by philoſophers; nor can there be any amicable union between the two. This will appear by ſome reflections upon the ſpirit of the ancient

cient and modern philoſophy concerning ſenſation.

During the reign of the Peripatetic philoſophy, our ſenſations were not minutely or accurately examined. The attention of philoſophers, as well as of the vulgar, was turned to the things ſignified by them: therefore, in conſequence of the common hypotheſis, it was taken for granted, that all the ſenſations we have from external things, are the forms or images of theſe external things. And thus the truth we have mentioned, yielded entirely to the hypotheſis, and was altogether ſuppreſſed by it.

DES CARTES gave a noble example of turning our attention inward, and ſcrutinizing our ſenſations; and this example hath been very worthily followed by modern philoſophers, particularly by MALEBRANCHE, LOCKE, BERKELEY, and HUME. The effect of this ſcrutiny hath been, a gradual diſcovery of the truth above mentioned, to wit, the diſſimilitude between the ſenſations of our minds, and the qualities or attributes of an inſentient inert ſubſtance, ſuch as we conceive matter to be. But this valuable and uſeful diſcovery, in its different ſtages, hath ſtill been unhappily united to the ancient hypotheſis; and, from

from this inauſpicious match of opinions, ſo unfriendly and diſcordant in their natures, have ariſen thoſe monſters of paradox and ſcepticiſm with which the modern philoſophy is too juſtly chargeable.

LOCKE ſaw clearly, and proved inconteſtably, that the ſenſations we have by taſte, ſmell, and hearing, as well as the ſenſations of colour, heat, and cold, are not reſemblances of any thing in bodies; and in this he agrees with DES CARTES and MALEBRANCHE. Joining this opinion with the hypotheſis, it follows neceſſarily, that three ſenſes of the five are cut off from giving us any intelligence of the material world, as being altogether inept for that office. Smell, and taſte, and ſound, as well as colour and heat, can have no more relation to body, than anger or gratitude; nor ought the former to be called qualities of body, whether primary or ſecondary, any more than the latter. For it was natural and obvious to argue thus from that hypotheſis: If heat, and colour, and ſound, are real qualities of body, the ſenſations, by which we perceive them, muſt be reſemblances of thoſe qualities; but theſe ſenſations are not reſemblances; therefore thoſe are not real qualities of body.

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We ſee then, that LOCKE, having found that the ideas of ſecondary qualities are no reſemblances, was compelled, by a hypotheſis common to all philoſophers, to deny that they are real qualities of body. It is more difficult to aſſign a reaſon, why, after this, he ſhould call them *ſecondary qualities;* for this name, if I miſtake not, was of his invention. Surely he did not mean that they were ſecondary qualities of the mind; and I do not ſee with what propriety, or even by what tolerable licence, he could call them ſecondary qualities of body, after finding that they were no qualities of body at all. In this, he ſeems to have ſacrificed to Common Senſe, and to have been led by her authority, even in oppoſition to his hypotheſis. The ſame ſovereign miſtreſs of our opinions that led this philoſopher to call thoſe things ſecondary qualities of body, which, according to his principles and reaſonings, were no qualities of body at all, hath led, not the vulgar of all ages only, but philoſophers alſo, and even the diſciples of LOCKE, to believe them to be real qualities of body: ſhe hath led them to inveſtigate, by experiments, the nature of colour, and ſound, and heat, in bodies. Nor hath this inveſtigation been fruitleſs, as it muſt have been, if there had

had been no ſuch thing in bodies: on the contrary, it hath produced very noble and uſeful diſcoveries, which make a very conſiderable part of natural philoſophy. If then natural philoſophy be not a dream, there is ſomething in bodies, which we call *colour*, and *heat*, and *ſound*. And if this be ſo, the hypotheſis from which the contrary is concluded, muſt be falſe: for the argument, leading to a falſe concluſion, recoils againſt the hypotheſis from which it was drawn, and thus directs its force backward. If the qualities of body were known to us only by ſenſations that reſemble them, then colour, and ſound, and heat, could be no qualities of body; but theſe are real qualities of body; and therefore the qualities of body are not known only by means of ſenſations that reſemble them.

But to proceed: What LOCKE had proved with regard to the ſenſations we have by ſmell, taſte, and hearing, Biſhop BERKELEY proved no leſs unanſwerably with regard to all our other ſenſations; to wit, that none of them can in the leaſt reſemble the qualities of a lifeleſs and inſentient being, ſuch as matter is conceived to be. Mr HUME hath confirmed this by his authority and reaſoning. This opinion ſurely looks with a very malign aſpect upon

upon the old hypotheſis; yet that hypotheſis hath ſtill been retained, and conjoined with it. And what a brood of monſters hath this produced!

The firſt-born of this union, and perhaps the moſt harmleſs, was, That the ſecondary qualities of body were mere ſenſations of the mind. To paſs by MALEBRANCHE's notion of ſeeing all things in the ideas of the divine mind, as a foreigner never naturalized in this iſland; the next was BERKELEY's ſyſtem, That extenſion, and figure, and hardneſs, and motion; that land, and ſea, and houſes, and our own bodies, as well as thoſe of our wives, and children, and friends, are nothing but ideas of the mind; and that there is nothing exiſting in nature, but minds and ideas.

The progeny that followed, is ſtill more frightful; ſo that it is ſurpriſing, that one could be found who had the courage to act the midwife, to rear it up, and to uſher it into the world. No cauſes nor effects; no ſubſtances, material or ſpiritual; no evidence even in mathematical demonſtration; no liberty nor active power; nothing exiſting in nature, but impreſſions and ideas following each other, without time, place, or ſubject. Surely no age ever produced ſuch a ſyſtem of opinions,

opinions, juſtly deduced with great acuteneſs, perſpicuity, and elegance, from a principle univerſally received. The hypotheſis we have mentioned, is the father of them all. The diſſimilitude of our ſenſations and feelings to external things, is the innocent mother of moſt of them.

As it happens ſometimes in an arithmetical operation, that two errors balance one another, ſo that the concluſion is little or nothing affected by them; but when one of them is corrected, and the other left, we are led farther from the truth, than by both together: ſo it ſeems to have happened in the Peripatetic philoſophy of ſenſation, compared with the modern. The Peripatetics adopted two errors; but the laſt ſerved as a corrective to the firſt, and rendered it mild and gentle; ſo that their ſyſtem had no tendency to ſcepticiſm. The moderns have retained the firſt of thoſe errors, but have gradually detected and corrected the laſt. The conſequence hath been, that the light we have ſtruck out hath created darkneſs, and ſcepticiſm hath advanced hand in hand with knowledge, ſpreading its melancholy gloom, firſt over the material world, and at laſt over the whole face of nature. Such a phenomenon as this, is apt to ſtagger

ſtagger even the lovers of light and knowledge, while its cauſe is latent; but when that is detected, it may give hopes, that this darkneſs ſhall not be everlaſting, but that it ſhall be ſucceeded by a more permanent light.

SECT. VII.

Of viſible figure and extenſion.

ALTHOUGH there is no reſemblance, nor, as far as we know, any neceſſary connection, between that quality in a body which we call its *colour*, and the appearance which that colour makes to the eye; it is quite otherwiſe with regard to its figure and magnitude. There is certainly a reſemblance, and a neceſſary connection, between the viſible figure and magnitude of a body, and its real figure and magnitude; no man can give a reaſon why a ſcarlet colour affects the eye in the manner it does; no man can be ſure that it affects his eye in the ſame manner as

it affects the eye of another, and that it has the same appearance to him as it has to another man; but we can assign a reason why a circle placed obliquely to the eye, should appear in the form of an ellipse. The visible figure, magnitude, and position, may, by mathematical reasoning, be deduced from the real; and it may be demonstrated, that every eye that sees distinctly and perfectly, must, in the same situation, see it under this form, and no other. Nay, we may venture to affirm, that a man born blind, if he were instructed in mathematics, would be able to determine the visible figure of a body, when its real figure, distance, and position, are given. Dr SAUNDERSON understood the projection of the sphere, and perspective. Now, I require no more knowledge in a blind man, in order to his being able to determine the visible figure of bodies, than that he can project the outline of a given body, upon the surface of a hollow sphere, whose centre is in the eye. This projection is the visible figure he wants; for it is the same figure with that which is projected upon the *tunica retina* in vision.

A blind man can conceive lines drawn from every point of the object to the centre of the eye, making angles. He can conceive, that the

the length of the object will appear greater or leſs, in proportion to the angle which it ſubtends at the eye; and that, in like manner, the breadth, and in general the diſtance of any one point of the object from any other point, will appear greater or leſs, in proportion to the angles which thoſe diſtances ſubtend. He can eaſily be made to conceive, that the viſible appearance has no thickneſs, any more than a projection of the ſphere, or a perſpective draught. He may be informed, that the eye, until it is aided by experience, does not repreſent one object as nearer or more remote than another. Indeed he would probably conjecture this of himſelf, and be apt to think, that the rays of light muſt make the ſame impreſſion upon the eye, whether they come from a greater or a leſs diſtance.

Theſe are all the principles which we ſuppoſe our blind mathematician to have; and theſe he may certainly acquire by information and reflection. It is no leſs certain, that from theſe principles, having given the real figure and magnitude of a body, and its poſition and diſtance with regard to the eye, he can find out its viſible figure and magnitude. He can demonſtrate in general, from theſe principles, that the viſible figure of all bodies

will be the ſame with that of their projection upon the ſurface of a hollow ſphere, when the eye is placed in the centre. And he can demonſtrate, that their viſible magnitude will be greater or leſs, according as their projection occupies a greater or leſs part of the ſurface of this ſphere.

To ſet this matter in another light, let us diſtinguiſh betwixt the *poſition* of objects with regard to the eye, and their *diſtance* from it. Objects that lie in the ſame right line drawn from the centre of the eye, have the ſame poſition, however different their diſtances from the eye may be: but objects which lie in different right lines drawn from the eye's centre, have a different poſition; and this difference of poſition is greater or leſs, in proportion to the angle made at the eye by the right lines mentioned. Having thus defined what we mean by the poſition of objects with regard to the eye, it is evident, that as the real figure of a body conſiſts in the ſituation of its ſeveral parts with regard to one another, ſo its viſible figure conſiſts in the poſition of its ſeveral parts with regard to the eye; and as he that hath a diſtinct conception of the ſituation of the parts of the body with regard to one another, muſt have a diſtinct conception

conception of its real figure; ſo he that conceives diſtinctly the poſition of its ſeveral parts with regard to the eye, muſt have a diſtinct conception of its viſible figure. Now, there is nothing ſurely to hinder a blind man from conceiving the poſition of the ſeveral parts of a body with regard to the eye, any more than from conceiving their ſituation with regard to one another; and therefore I conclude, that a blind man may attain a diſtinct conception of the viſible figure of bodies.

Although we think the arguments that have been offered are ſufficient to prove, that a blind man may conceive the viſible extenſion and figure of bodies; yet, in order to remove ſome prejudices againſt this truth, it will be of uſe to compare the notion which a blind mathematician might form to himſelf of viſible figure, with that which is preſented to the eye in viſion, and to obſerve wherein they differ.

Firſt, Viſible figure is never preſented to the eye but in conjunction with colour; and although there be no connection between them from the nature of the things, yet, having ſo invariably kept company together, we are hardly able to disjoin them even in our imagination. What mightily increaſes this

difficulty is, that we have never been accuſtomed to make viſible figure an object of thought. It is only uſed as a ſign, and, having ſerved this purpoſe, paſſes away, without leaving a trace behind. The drawer or deſigner, whoſe buſineſs it is to hunt this fugitive form, and to take a copy of it, finds how diffi ult his taſk is, after many years labour and practice. Happy! if at laſt he can acquire the art of arreſting it in his imagination, until he can delineate it. For then it is evident, that he muſt be able to draw as accurately from the life as from a copy. But how few of the profeſſed maſters of deſigning are ever able to arrive at this degree of perfection? it is no wonder, then, that we ſhould find ſo great difficulty in conceiving this form apart from its conſtant aſſociate, when it is ſo difficult to conceive it at all. But our blind man's notion of viſible figure will not be aſſociated with colour, of which he hath no conception; but it will perhaps be aſſociated with hardneſs or ſmoothneſs, with which he is acquainted by touch. Theſe different aſſociations are apt to impoſe upon us, and to make things ſeem different, which in reality are the ſame.

Secondly,

Secondly, The blind man forms the notion of viſible figure to himſelf, by thought, and by mathematical reaſoning from principles; whereas the man that ſees, has it preſented to his eye at once, without any labour, without any reaſoning, by a kind of inſpiration. A man may form to himſelf the notion of a parabola, or a cycloid, from the mathematical definition of thoſe figures, although he had never ſeen them drawn or delineated. Another, who knows nothing of the mathematical definition of the figures, may ſee them delineated on paper, or feel them cut out in wood. Each may have a diſtinct conception of the figures, one by mathematical reaſoning, the other by ſenſe. Now, the blind man forms his notion of viſible figure in the ſame manner as the firſt of theſe formed his notion of a parabola or a cycloid, which he never ſaw.

Thirdly, Viſible figure leads the man that ſees, directly to the conception of the real figure, of which it is a ſign. But the blind man's thoughts move in a contrary direction. For he muſt firſt know the real figure, diſtance, and ſituation, of the body, and from thence he ſlowly traces out the viſible figure by mathematical reaſoning. Nor does his

nature lead him to conceive this viſible figure as a ſign; it is a creature of his own reaſon and imagination.

SECT. VIII.

Some queries concerning viſible figure anſwered.

IT may be aſked, What kind of thing is this viſible figure? Is it a ſenſation, or an idea? If it is an idea, from what ſenſation is it copied? Theſe queſtions may ſeem trivial or impertinent to one who does not know, that there is a tribunal of inquiſition erected by certain modern philoſophers, before which every thing in nature muſt anſwer. The articles of inquiſition are few indeed, but very dreadful in their conſequences. They are only theſe: Is the priſoner an impreſſion or an idea? If an idea, from what impreſſion copied? Now, if it appears that the priſoner is neither an impreſſion, nor an idea copied from ſome impreſſion, immediately, without being allowed

allowed to offer any thing in arreſt of judgment, he is ſentenced to paſs out of exiſtence, and to be, in all time to come, an empty unmeaning ſound, or the ghoſt of a departed entity.

Before this dreadful tribunal, cauſe and effect, time and place, matter and ſpirit, have been tried and caſt: how then ſhall ſuch a poor flimſy form as viſible figure ſtand before it? It muſt even plead guilty, and confeſs that it is neither an impreſſion nor an idea. For, alas! it is notorious, that it is extended in length and breadth; it may be long or ſhort, broad or narrow, triangular, quadrangular, or circular: and therefore, unleſs ideas and impreſſions are extended and figured, it cannot belong to that category.

If it ſhould ſtill be aſked, To what category of beings does viſible figure then belong? I can only, in anſwer, give ſome tokens, by which thoſe who are better acquainted with the categories, may chance to find its place. It is, as we have ſaid, the poſition of the ſeveral parts of a figured body, with regard to the eye. The different poſitions of the ſeveral parts of the body with regard to the eye, when put together, make a real figure, which is truly extended in length and breadth, and which repreſents

repreſents a figure that is extended in length, breadth, and thickneſs. In like manner, a projection of the ſphere is a real figure, and hath length and breadth, but repreſents the ſphere, which hath three dimenſions. A projection of the ſphere, or a perſpective view of a palace, is a repreſentative in the very ſame ſenſe as viſible figure is, and wherever they have their lodgings in the categories, this will be found to dwell next door to them.

It may farther be aſked, Whether there be any ſenſation proper to viſible figure, by which it is ſuggeſted in viſion? Or by what means it is preſented to the mind? This is a queſtion of ſome importance, in order to our having a diſtinct notion of the faculty of ſeeing: and to give all the light to it we can, it is neceſſary to compare this ſenſe with other ſenſes, and to make ſome ſuppoſitions, by which we may be enabled to diſtinguiſh things that are apt to be confounded, although they are totally different.

There are three of our ſenſes which give us intelligence of things at a diſtance: ſmell, hearing, and ſight. In ſmelling, and in hearing, we have a ſenſation or impreſſion upon the mind, which, by our conſtitution, we conceive to be a ſign of ſomething external: but the

the position of this external thing, with regard to the organ of sense, is not presented to the mind along with the sensation. When I hear the sound of a coach, I could not, previous to experience, determine whether the sounding body was above or below, to the right hand or to the left. So that the sensation suggests to me some external object as the cause or occasion of it; but it suggests not the position of that object, whether it lies in this direction or in that. The same thing may be said with regard to smelling. But the case is quite different with regard to seeing. When I see an object, the appearance which the colour of it makes, may be called *the sensation*, which suggests to me some external thing as its cause; but it suggests likewise the individual direction and position of this cause with regard to the eye. I know it is precisely in such a direction, and in no other. At the same time, I am not conscious of any thing that can be called *sensation*, but the sensation of colour. The position of the coloured thing is no sensation, but it is by the laws of my constitution presented to the mind along with the colour, without any additional sensation.

Let us suppose, that the eye were so constituted, that the rays coming from any one point of

of the object were not, as they are in our eyes, collected in one point of the *retina*, but diffuſed over the whole: It is evident to thoſe who underſtand the ſtructure of the eye, that ſuch an eye as we have ſuppoſed, would ſhew the colour of a body as our eyes do, but that it would neither ſhew figure nor poſition. The operation of ſuch an eye would be preciſely ſimilar to that of hearing and ſmell; it would give no perception of figure or extenſion, but merely of colour. Nor is the ſuppoſition we have made altogether imaginary: for it is nearly the caſe of moſt people who have cataracts, whoſe cryſtalline, as Mr CHESELDEN obſerves, does not altogether exclude the rays of light, but diffuſes them over the *retina*, ſo that ſuch perſons ſee things as one does through a glaſs of broken jelly: they perceive the colour, but nothing of the figure or magnitude of objects.

Again, if we ſhould ſuppoſe, that ſmell and ſound were conveyed in right lines from the objects, and that every ſenſation of hearing and ſmell ſuggeſted the preciſe direction or poſition of its object; in this caſe, the operations of hearing and ſmelling would be ſimilar to that of ſeeing: we ſhould ſmell and hear the figure of objects, in the ſame ſenſe

as

as now we ſee it; and every ſmell and ſound would be aſſociated with ſome figure in the imagination, as colour is in our preſent ſtate.

We have reaſon to believe, that the rays of light make ſome impreſſion upon the *retina*; but we are not conſcious of this impreſſion; nor have anatomiſts or philoſophers been able to diſcover the nature and effects of it; whether it produces a vibration in the nerve, or the motion of ſome ſubtile fluid contained in the nerve, or ſomething different from either, to which we cannot give a name. Whatever it is, we ſhall call it the *material impreſſion*; remembering carefully, that it is not an impreſſion upon the mind, but upon the body; and that it is no ſenſation, nor can reſemble ſenſation, any more than figure or motion can reſemble thought. Now, this material impreſſion, made upon a particular point of the *retina*, by the laws of our conſtitution, ſuggeſts two things to the mind, namely, the colour, and the poſition of ſome external object. No man can give a reaſon, why the ſame material impreſſion might not have ſuggeſted ſound, or ſmell, or either of theſe, along with the poſition of the object. That it ſhould ſuggeſt colour and poſition, and nothing elſe, we can reſolve only into our conſtitution, or the

the will of our Maker. And ſince there is no neceſſary connection between theſe two things ſuggeſted by this material impreſſion, it might, if it had ſo pleaſed our Creator, have ſuggeſted one of them without the other. Let us ſuppoſe, therefore, ſince it plainly appears to be poſſible, that our eyes had been ſo framed, as to ſuggeſt to us the poſition of the object, without ſuggeſting colour, or any other quality: What is the conſequence of this ſuppoſition? It is evidently this, that the perſon endued with ſuch an eye, would perceive the viſible figure of bodies, without having any ſenſation or impreſſion made upon his mind. The figure he perceives is altogether external; and therefore cannot be called an impreſſion upon the mind, without the groſſeſt abuſe of language. If it ſhould be ſaid, that it is impoſſible to perceive a figure, unleſs there be ſome impreſſion of it upon the mind; I beg leave not to admit the impoſſibility of this, without ſome proof: and I can find none. Neither can I conceive what is meant by an impreſſion of figure upon the mind. I can conceive an impreſſion of figure upon wax, or upon any body that is fit to receive it; but an impreſſion of it upon the mind, is to me quite unintelligible; and although I form the moſt

moſt diſtinct conception of the figure, I cannot, upon the ſtricteſt examination, find any impreſſion of it upon my mind.

If we ſuppoſe, laſt of all, that the eye hath the power reſtored of perceiving colour, I apprehend that it will be allowed, that now it perceives figure in the very ſame manner as before, with this difference only, that colour is always joined with it.

In anſwer therefore to the queſtion propoſed, there ſeems to be no ſenſation that is appropriated to viſible figure, or whoſe office it is to ſuggeſt it. It ſeems to be ſuggeſted immediately by the material impreſſion upon the organ, of which we are not conſcious: and why may not a material impreſſion upon the *retina* ſuggeſt viſible figure, as well as the material impreſſion made upon the hand, when we graſp a ball, ſuggeſts real figure? In the one caſe, one and the ſame material impreſſion, ſuggeſts both colour and viſible figure; and in the other caſe, one and the ſame material impreſſion ſuggeſts hardneſs, heat, or cold, and real figure, all at the ſame time.

We ſhall conclude this ſection with another queſtion upon this ſubject. Since the viſible figure of bodies is a real and external object to the eye, as their tangible figure is to the touch;

touch; it may be aſked, Whence ariſes the difficulty of attending to the firſt, and the facility of attending to the laſt? It is certain, that the firſt is more frequently preſented to the eye, than the laſt is to the touch; the firſt is as diſtinct and determinate an object as the laſt, and ſeems in its own nature as proper for ſpeculation. Yet ſo little hath it been attended to, that it never had a name in any language, until Biſhop BERKELEY gave it that which we have uſed after his example, to diſtinguiſh it from the figure which is the object of touch.

The difficulty of attending to the viſible figure of bodies, and making it an object of thought, appears ſo ſimilar to that which we find in attending to our ſenſations, that both have probably like cauſes. Nature intended the viſible figure as a ſign of the tangible figure and ſituation of bodies, and hath taught us by a kind of inſtinct to put it always to this uſe. Hence it happens, that the mind paſſes over it with a rapid motion, to attend to the things ſignified by it. It is as unnatural to the mind to ſtop at the viſible figure, and attend to it, as it is to a ſpherical body to ſtop upon an inclined plane. There is an inward principle, which conſtantly carries it forward,

ward, and which cannot be overcome but by a contrary force.

There are other external things which nature intended for ſigns; and we find this common to them all, that the mind is diſpoſed to overlook them, and to attend only to the things ſignified by them. Thus there are certain modifications of the human face, which are natural ſigns of the preſent diſpoſition of the mind. Every man underſtands the meaning of theſe ſigns, but not one of a hundred ever attended to the ſigns themſelves, or knows any thing about them. Hence you may find many an excellent practical phyſiognomiſt, who knows nothing of the proportions of a face, nor can delineate or deſcribe the expreſſion of any one paſſion.

An excellent painter or ſtatuary can tell, not only what are the proportions of a good face, but what changes every paſſion makes in it. This, however, is one of the chief myſteries of his art, to the acquiſition of which, infinite labour and attention, as well as a happy genius, are required. But when he puts his art in practice, and happily expreſſes a paſſion by its proper ſigns, every one underſtands the meaning of theſe ſigns, without art, and without reflection.

What has been ſaid of painting, might eaſily be applied to all the fine arts. The difficulty in them all conſiſts in knowing and attending to thoſe natural ſigns, whereof every man underſtands the meaning.

We paſs from the ſign to the thing ſignified, with eaſe, and by natural impulſe; but to go backward from the thing ſignified to the ſign, is a work of labour and difficulty. Viſible figure, therefore, being intended by nature to be a ſign, we paſs on immediately to the thing ſignified, and cannot eaſily return to give any attention to the ſign.

Nothing ſhews more clearly our indiſpoſition to attend to viſible figure and viſible extenſion than this, that although mathematical reaſoning is no leſs applicable to them, than to tangible figure and extenſion, yet they have entirely eſcaped the notice of mathematicians. While that figure and that extenſion which are objects of touch, have been tortured ten thouſand ways for twenty centuries, and a very noble ſyſtem of ſcience has been drawn out of them; not a ſingle propoſition do we find with regard to the figure and extenſion which are the immediate objects of ſight!

When the geometrician draws a diagram with the moſt perfect accuracy; when he keeps

keeps his eye fixed upon it, while he goes through a long proceſs of reaſoning, and demonſtrates the relations of the ſeveral parts of his figure; he does not conſider, that the viſible figure preſented to his eye, is only the repreſentative of a tangible figure, upon which all his attention is fixed; he does not conſider that theſe two figures have really different properties; and that what he demonſtrates to be true of the one, is not true of the other.

This perhaps will ſeem ſo great a paradox, even to mathematicians, as to require demonſtration before it can be believed. Nor is the demonſtration at all difficult, if the reader will have patience to enter but a little into the mathematical conſideration of viſible figure, which we ſhall call *the geometry of viſibles*.

SECT. IX.

Of the geometry of viſibles.

IN this geometry, the definitions of a point; of a line, whether ſtraight or curve; of an angle, whether acute, or right, or obtuſe; and of a circle, are the ſame as in common geometry. The mathematical reader will eaſily enter into the whole myſtery of this geometry, if he attends duly to theſe few evident principles.

1. Suppoſing the eye placed in the centre of a ſphere, every great circle of the ſphere will have the ſame appearance to the eye as if it was a ſtraight line. For the curvature of the circle being turned directly toward the eye, is not perceived by it. And for the ſame reaſon, any line which is drawn in the plane of a great circle of the ſphere, whether it be in reality ſtraight or curve, will appear ſtraight to the eye.

2. Every viſible right line will appear to coincide with ſome great circle of the ſphere; and

and the circumference of that great circle, even when it is produced until it returns into itſelf, will appear to be a continuation of the ſame viſible right line, all the parts of it being viſibly *in directum.* For the eye, perceiving only the poſition of objects with regard to itſelf, and not their diſtance, will ſee thoſe points in the ſame viſible place which have the ſame poſition with regard to the eye, how different ſoever their diſtances from it may be. Now, ſince a plane paſſing through the eye and a given viſible right line, will be the plane of ſome great circle of the ſphere, every point of the viſible right line will have the ſame poſition as ſome point of the great circle; therefore they will both have the ſame viſible place, and coincide to the eye: and the whole circumference of the great circle continued even until it returns into itſelf, will appear to be a continuation of the ſame viſible right line.

Hence it follows:

3. That every viſible right line, when it is continued *in directum*, as far as it may be continued, will be repreſented by a great circle of a ſphere, in whoſe centre the eye is placed. It follows,

4. That the viſible angle comprehended under two viſible right lines, is equal to the

ſpherical angle comprehended under the two great circles which are the repreſentatives of theſe viſible lines. For ſince the viſible lines appear to coincide with the great circles, the viſible angle comprehended under the former, muſt be equal to the viſible angle comprehended under the latter. But the viſible angle comprehended under the two great circles, when ſeen from the centre, is of the ſame magnitude with the ſpherical angle which they really comprehend, as mathematicians know; therefore the viſible angle made by any two viſible lines, is equal to the ſpherical angle made by the two great circles of the ſphere which are their repreſentatives.

5. Hence it is evident, that every viſible right-lined triangle, will coincide in all its parts with ſome ſpherical triangle. The ſides of the one will appear equal to the ſides of the other, and the angles of the one to the angles of the other, each to each; and therefore the whole of the one triangle will appear equal to the whole of the other. In a word, to the eye they will be one and the ſame, and have the ſame mathematical properties. The properties therefore of viſible right-lined triangles, are not the ſame with the properties of

of plain triangles, but are the ſame with thoſe of ſpherical triangles.

6. Every leſſer circle of the ſphere, will appear a circle to the eye, placed, as we have ſuppoſed all along, in the centre of the ſphere. And, on the other hand, every viſible circle will appear to coincide with ſome leſſer circle of the ſphere.

7. Moreover, the whole ſurface of the ſphere will repreſent the whole of viſible ſpace: for ſince every viſible point coincides with ſome point of the ſurface of the ſphere, and has the ſame viſible place, it follows, that all the parts of the ſpherical ſurface taken together, will repreſent all poſſible viſible places, that is, the whole of viſible ſpace. And from this it follows, in the laſt place,

8. That every viſible figure will be repreſented by that part of the ſurface of the ſphere, on which it might be projected, the eye being in the centre. And every ſuch viſible figure will bear the ſame *ratio* to the whole of viſible ſpace, as the part of the ſpherical ſurface which repreſents it, bears to the whole ſpherical ſurface.

The mathematical reader, I hope, will enter into theſe principles with perfect facility, and will as eaſily perceive, that the following

propoſitions with regard to viſible figure and ſpace, which we offer only as a ſpecimen, may be mathematically demonſtrated from them, and are not leſs true nor leſs evident than the propoſitions of Euclid, with regard to tangible figures.

Prop. 1. Every right line being produced, will at laſt return into itſelf.

2. A right line returning into itſelf, is the longeſt poſſible right line; and all other right lines bear a finite *ratio* to it.

3. A right line returning into itſelf, divides the whole of viſible ſpace into two equal parts, which will both be comprehended under this right line.

4. The whole of viſible ſpace bears a finite *ratio* to any part of it.

5. Any two right lines being produced, will meet in two points, and mutually biſect each other.

6. If two lines be parallel, that is, every where equally diſtant from each other, they cannot both be ſtraight.

7. Any right line being given, a point may be found, which is at the ſame diſtance from all the points of the given right line.

8. A circle may be parallel to a right line, that

that is, may be equally diſtant from it in all its parts.

9. Right-lined triangles that are ſimilar, are alſo equal.

10. Of every right-lined triangle, the three angles taken together, are greater than two right angles.

11. The angles of a right-lined triangle, may all be right angles, or all obtuſe angles.

12. Unequal circles are not as the ſquares of their diameters, nor are their circumferences in the *ratio* of their diameters.

This ſmall ſpecimen of the geometry of viſibles, is intended to lead the reader to a clear and diſtinct conception of the figure and extenſion which is preſented to the mind by viſion; and to demonſtrate the truth of what we have affirmed above, namely, That thoſe figures and that extenſion which are the immediate objects of ſight, are not the figures and the extenſion about which common geometry is employed; that the geometrician, while he looks at his diagram, and demonſtrates a propoſition, hath a figure preſented to his eye, which is only a ſign and repreſentative of a tangible figure; that he gives not the leaſt attention to the firſt, but attends only

ly to the laſt; and that theſe two figures have different properties, ſo that what he demonſtrates of the one, is not true of the other.

It deſerves, however, to be remarked, that as a ſmall part of a ſpherical ſurface differs not ſenſibly from a plain ſurface; ſo a ſmall part of viſible extenſion differs very little from that extenſion in length and breadth, which is the object of touch. And it is likewiſe to be obſerved, that the human eye is ſo formed, that an object which is ſeen diſtinctly and at one view, can occupy but a ſmall part of viſible ſpace: for we never ſee diſtinctly what is at a conſiderable diſtance from the axis of the eye; and therefore, when we would ſee a large object at one view, the eye muſt be at ſo great a diſtance, that the object occupies but a ſmall part of viſible ſpace. From theſe two obſervations, it follows, that plain figures which are ſeen at one view, when their planes are not oblique, but direct to the eye, differ little from the viſible figures which they preſent to the eye. The ſeveral lines in the tangible figure have very nearly the ſame proportion to each other as in the viſible; and the angles of the one are very nearly, although not ſtrictly and mathematically, equal to thoſe of the other. Although therefore we

we have found many inſtances of natural ſigns which have no ſimilitude to the things ſignified, this is not the caſe with regard to viſible figure. It hath in all caſes ſuch a ſimilitude to the thing ſignified by it, as a plan or profile hath to that which it repreſents; and in ſome caſes the ſign and thing ſignified have to all ſenſe the ſame figure and the ſame proportions. If we could find a being endued with ſight only, without any other external ſenſe, and capable of reflecting and reaſoning upon what he ſees, the notions and philoſophical ſpeculations of ſuch a being, might aſſiſt us in the difficult taſk of diſtinguiſhing the perceptions which we have purely by ſight, from thoſe which derive their origin from other ſenſes. Let us ſuppoſe ſuch a being, and conceive, as well as we can, what notion he would have of viſible objects, and what concluſions he would deduce from them. We muſt not conceive him diſpoſed by his conſtitution, as we are, to conſider the viſible appearance as a ſign of ſomething elſe: it is no ſign to him, becauſe there is nothing ſignified by it; and therefore we muſt ſuppoſe him as much diſpoſed to attend to the viſible figure and extenſion of bodies, as we are diſpoſed

poſed to attend to their tangible figure and extenſion.

If various figures were preſented to his ſenſe, he might, without doubt, as they grow familiar, compare them together, and perceive wherein they agree, and wherein they differ. He might perceive viſible objects to have length and breadth, but could have no notion of a third dimenſion, any more than we can have of a fourth. All viſible objects would appear to be terminated by lines, ſtraight or curve; and objects terminated by the ſame viſible lines, would occupy the ſame place, and fill the ſame part of viſible ſpace. It would not be poſſible for him to conceive one object to be behind another, or one to be nearer, another more diſtant.

To us, who conceive three dimenſions, a line may be conceived ſtraight; or it may be conceived incurvated in one dimenſion, and ſtraight in another; or, laſtly, it may be incurvated in two dimenſions. Suppoſe a line, to be drawn upwards and downwards, its length makes one dimenſion, which we ſhall call *upwards and downwards;* and there are two dimenſions remaining, according to which it may be ſtraight or curve. It may be bent to the right or to the left; and if it has no bending

ing either to right or left, it is ſtraight in this dimenſion. But ſuppoſing it ſtraight in this dimenſion of right and left, there is ſtill another dimenſion remaining, in which it may be curve; for it may be bent backwards or forwards. When we conceive a tangible ſtraight line, we exclude curvature in either of theſe two dimenſions: and as what is conceived to be excluded, muſt be conceived, as well as what is conceived to be included, it follows, that all the three dimenſions enter into our conception of a ſtraight line. Its length is one dimenſion, its ſtraightneſs in two other dimenſions is included, or curvature in theſe two dimenſions excluded, in the conception of it.

The being we have ſuppoſed, having no conception of more than two dimenſions, of which the length of a line is one, cannot poſſibly conceive it either ſtraight or curve in more than one dimenſion: ſo that in his conception of a right line, curvature to the right hand or left is excluded; but curvature backwards or forwards cannot be excluded, becauſe he neither hath, nor can have any conception of ſuch curvature. Hence we ſee the reaſon that a line, which is ſtraight to the eye, may return into itſelf: for its being ſtraight

ſtraight to the eye, implies only ſtraightneſs in one dimenſion; and a line, which is ſtraight in one dimenſion, may notwithſtanding be curve in another dimenſion, and ſo may return into itſelf.

To us, who conceive three dimenſions, a ſurface is that which hath length and breadth, excluding thickneſs: and a ſurface may be either plain in this third dimenſion, or it may be incurvated: ſo that the notion of a third dimenſion enters into our conception of a ſurface; for it is only by means of this third dimenſion, that we can diſtinguiſh ſurfaces into plain and curve ſurfaces; and neither one nor the other can be conceived, without conceiving a third dimenſion.

The being we have ſuppoſed having no conception of a third dimenſion, his viſible figures have length and breadth indeed; but thickneſs is neither included nor excluded, being a thing of which he has no conception. And therefore viſible figures, although they have length and breadth, as ſurfaces have, yet they are neither plain ſurfaces, nor curve ſurfaces. For a curve ſurface implies curvature in a third dimenſion, and a plain ſurface implies the want of curvature in a third dimenſion; and ſuch a being can conceive neither of theſe, becauſe

becauſe he has no conception of a third dimenſion. Moreover, although he hath a diſtinct conception of the inclination of two lines which make an angle, yet he can neither conceive a plain angle nor a ſpherical angle. Even his notion of a point is ſomewhat leſs determined than ours. In the notion of a point, we exclude length, breadth, and thickneſs; he excludes length and breadth, but cannot either exclude or include thickneſs, becauſe he hath no conception of it.

Having thus ſettled the notions which ſuch a being as we have ſuppoſed might form of mathematical points, lines, angles, and figures, it is eaſy to ſee, that by comparing theſe together, and reaſoning about them, he might diſcover their relations, and form geometrical concluſions, built upon ſelf-evident principles. He might likewiſe, without doubt, have the ſame notion of numbers as we have, and form a ſyſtem of arithmetic. It is not material to ſay in what order he might proceed in ſuch diſcoveries, or how much time and pains he might employ about them; but what ſuch a being, by reaſon and ingenuity, without any materials of ſenſation but thoſe of ſight only, might diſcover.

As

As it is more difficult to attend to a detail of poſſibilities, than of facts even of ſlender authority, I ſhall beg leave to give an extract from the travels of JOHANNES RUDOLPHUS ANEPIGRAPHUS, a Roſicrucian philoſopher, who having, by deep ſtudy of the occult ſciences, acquired the art of tranſporting himſelf to various ſublunary regions, and of converſing with various orders of intelligences, in the courſe of his adventures, became acquainted with an order of beings exactly ſuch as I have ſuppoſed.

How they communicate their ſentiments to one another, and by what means he became acquainted with their language, and was initiated into their philoſophy, as well as of many other particulars, which might have gratified the curioſity of his readers, and perhaps added credibility to his relation, he hath not thought fit to inform us; theſe being matters proper for adepts only to know.

His account of their philoſophy is as follows:

"The Idomenians," ſaith he, "are many "of them very ingenious, and much given to "contemplation. In arithmetic, geometry, "metaphyſics, and phyſics, they have moſt "elaborate ſyſtems. In the two latter indeed "they

" they have had many diſputes, carried on " with great ſubtilty, and are divided into va- " rious ſects; yet in the two former there hath " been no leſs unanimity than among the hu- " man ſpecies. Their principles relating to " numbers and arithmetic, making allowance " for their notation, differ in nothing from " ours: but their geometry differs very con- " ſiderably."

As our author's account of the geometry of the Idomenians agrees in every thing with the geometry of viſibles, of which we have already given a ſpecimen, we ſhall paſs over it. He goes on thus: " Colour, extenſion, " and figure, are conceived to be the eſſen- " tial properties of body. A very conſider- " able ſect maintains, that colour is the ef- " fence of body. If there had been no co- " lour, ſay they, there had been no percep- " tion or ſenſation. Colour is all that we " perceive, or can conceive, that is peculiar " to body; extenſion and figure being modes " common to body and to empty ſpace. And " if we ſhould ſuppoſe a body to be annihi- " lated, colour is the only thing in it that can " be annihilated; for its place, and conſe- " quently the figure and extenſion of that " place, muſt remain, and cannot be imagi-

" ned not to exiſt. Theſe philoſophers hold " ſpace to be the place of all bodies, immove- " able and indeſtructible, without figure, and " ſimilar in all its parts, incapable of increaſe " or diminution, yet not unmeaſurable: for " every the leaſt part of ſpace bears a finite " *ratio* to the whole. So that with them the " whole extent of ſpace is the common and " natural meaſure of every thing that hath " length and breadth, and the magnitude of " every body and of every figure is expreſſed " by its being ſuch a part of the univerſe. " In like manner, the common and natural " meaſure of length, is an infinite right line, " which, as hath been before obſerved, re- " turns into itſelf, and hath no limits, but " bears a finite *ratio* to every other line.

" As to their natural philoſophy, it is now " acknowledged by the wiſeſt of them to " have been for many ages in a very low ſtate. " The philoſophers obſerving, that one body " can differ from another only in colour, fi- " gure, or magnitude, it was taken for grant- " ed, that all their particular qualities muſt " ariſe from the various combinations of theſe " their eſſential attributes. And therefore it " was looked upon as the end of natural phi- " loſophy, to ſhew how the various combina-

" tions

" tions of these three qualities in different bo-
" dies produced all the phenomena of na-
" ture. It were endless to enumerate the va-
" rious systems that were invented with this
" view, and the disputes that were carried on
" for ages; the followers of every system ex-
" posing the weak sides of other systems, and
" palliating those of their own, with great
" art.

" At last, some free and facetious spirits,
" wearied with eternal disputation, and the
" labour of patching and propping weak sys-
" tems, began to complain of the subtilty of
" nature; of the infinite changes that bodies
" undergo in figure, colour, and magnitude;
" and of the difficulty of accounting for these
" appearances, making this a pretence for
" giving up all inquiries into the causes of
" things, as vain and fruitless.

" These wits had ample matter of mirth
" and ridicule in the systems of philosophers,
" and finding it an easier task to pull down
" than to build or support, and that every
" sect furnished them with arms and auxili-
" aries to destroy another, they began to
" spread mightily, and went on with great
" success. Thus philosophy gave way to
" scepticism and irony, and those systems

" which had been the work of ages, and the " admiration of the learned, became the jeſt " of the vulgar: for even the vulgar readily " took part in the triumph over a kind of " learning which they had long ſuſpected, be- " cauſe it produced nothing but wrangling " and altercation. The wits having now " acquired great reputation, and being fluſh- " ed with ſucceſs, began to think the triumph " incomplete, until every pretence to know- " ledge was overturned; and accordingly be- " gan their attacks upon arithmetic, geome- " try, and even upon the common notions of " untaught Idomenians. So difficult it hath " always been (ſays our author) for great " conquerors to know where to ſtop.

" In the mean time, natural philoſophy be- " gan to riſe from its aſhes, under the direc- " tion of a perſon of great genius, who is " looked upon as having had ſomething in " him above Idomenian nature. He obſer- " ved, that the Idomenian faculties were cer- " tainly intended for contemplation, and that " the works of nature were a nobler ſubject " to exerciſe them upon, than the follies of " ſyſtems, or the errors of the learned; and " being ſenſible of the difficulty of finding " out the cauſes of natural things, he propo-

" ſed,

" ſed, by accurate obſervation of the pheno-
" mena of nature, to find out the rules ac-
" cording to which they happen, without in-
" quiring into the cauſes of thoſe rules. In
" this he made conſiderable progreſs himſelf,
" and planned out much work for his follow-
" ers, who call themſelves *inductive philoſo-*
" *phers*. The ſceptics look with envy upon
" this riſing ſect, as eclipſing their reputation,
" and threatening to limit their empire; but
" they are at a loſs on what hand to attack
" it. The vulgar begin to reverence it, as
" producing uſeful diſcoveries.

" It is to be obſerved, that every Idome-
" nian firmly believes, that two or more bo-
" dies may exiſt in the ſame place. For this
" they have the teſtimony of ſenſe, and they
" can no more doubt of it, than they can
" doubt whether they have any perception
" at all. They often ſee two bodies meet,
" and coincide in the ſame place, and ſepa-
" rate again, without having undergone any
" change in their ſenſible qualities by this
" penetration. When two bodies meet, and
" occupy the ſame place, commonly one on-
" ly appears in that place, and the other diſ-
" appears. That which continues to appear

" is ſaid to overcome, the other to be over-
" come."

To this quality of bodies they gave a name, which our author tells us hath no word anſwering to it in any human language. And therefore, after making a long apology, which I omit, he begs leave to call it *the overcoming quality of bodies*. He aſſures us, that " the " ſpeculations which had been raiſed about " this ſingle quality of bodies, and the hypo- " theſes contrived to account for it, were ſuf- " ficient to fill many volumes. Nor have " there been fewer hypotheſes invented by " their philoſophers, to account for the chan- " ges of magnitude and figure; which, in " moſt bodies that move, they perceive to be " in a continual fluctuation. The founder " of the inductive ſect, believing it to be " above the reach of Idomenian faculties, " to diſcover the real cauſes of theſe phæno- " mena, applied himſelf to find from obſer- " vation, by what laws they are connected " together; and diſcovered many mathema- " tical ratios and relations concerning the " motions, magnitudes, figures, and over- " coming quality of bodies, which conſtant " experience confirms. But the oppoſers of " this ſect chooſe rather to content themſelves " with

" with feigned cauſes of theſe phenomena,
" than to acknowledge the real laws where-
" by they are governed, which humble their
" pride, by being confeſſedly unaccount-
" able."

Thus far JOHANNES RUDOLPHUS ANEPIGRAPHUS. Whether this ANEPIGRAPHUS be the ſame who is recorded among the Greek alchemiſtical writers not yet publiſhed, by BORRICHIUS, FABRICIUS, and others, I do not pretend to determine. The identity of their name, and the ſimilitude of their ſtudies, although no ſlight arguments, yet are not abſolutely concluſive. Nor will I take upon me to judge of the narrative of this learned traveller by the *external* marks of his credibility; I ſhall confine myſelf to thoſe which the critics call *internal*. It would even be of ſmall importance to inquire, whether the Idomenians have a real, or only an ideal exiſtence; ſince this is diſputed among the learned with regard to things with which we are more nearly connected. The important queſtion is, Whether the account above given, is a juſt account of their geometry and philoſophy? We have all the faculties which they have, with the addition of others which they have not; we may therefore form ſome judg-

ment of their philoſophy and geometry, by ſeparating from all others, the perceptions we have by ſight, and reaſoning upon them. As far as I am able to judge in this way, after a careful examination, their geometry muſt be ſuch as ANEPIGRAPHUS hath deſcribed. Nor does his account of their philoſophy appear to contain any evident marks of impoſture; although here, no doubt, proper allowance is to be made for liberties which travellers take, as well as for involuntary miſtakes which they are apt to fall into.

SECT. X.

Of the parallel motion of the eyes.

HAVING explained, as diſtinctly as we can, viſible figure, and ſhewn its connection with the things ſignified by it, it will be proper next to conſider ſome phenomena of the eyes, and of viſion, which have commonly been referred to cuſtom, to anatomical or to mechanical cauſes; but which, as I conceive,

ceive, muſt be reſolved into original powers and principles of the human mind; and therefore belong properly to the ſubject of this inquiry.

The firſt is, the parallel motion of the eyes; by which, when one eye is turned to the right or to the left, upwards or downwards, or ſtraight forwards, the other always goes along with it in the ſame direction. We ſee plainly, when both eyes are open, that they are always turned the ſame way, as if both were acted upon by the ſame motive force: and if one eye is ſhut, and the hand laid upon it, while the other turns various ways, we feel the eye that is ſhut turn at the ſame time, and that whether we will or not. What makes this phenomenon ſurpriſing is, that it is acknowledged by all anatomiſts, that the muſcles which move the two eyes, and the nerves which ſerve theſe muſcles, are entirely diſtinct and unconnected. It would be thought very ſurpriſing and unaccountable, to ſee a man, who, from his birth, never moved one arm, without moving the other preciſely in the ſame manner, ſo as to keep them always parallel: yet it would not be more difficult to find the phyſical cauſe of ſuch motion of the arms, than it is to find the cauſe of the parallel

rallel motion of the eyes, which is perfectly ſimilar.

The only cauſe that hath been aſſigned of this parallel motion of the eyes, is cuſtom. We find by experience, it is ſaid, when we begin to look at objects, that, in order to have diſtinct viſion, it is neceſſary to turn both eyes the ſame way; therefore we ſoon acquire the habit of doing it conſtantly, and by degrees loſe the power of doing otherwiſe.

This account of the matter ſeems to be inſufficient; becauſe habits are not got at once; it takes time to acquire and to confirm them; and if this motion of the eyes were got by habit, we ſhould ſee children, when they are born, turn their eyes different ways, and move one without the other, as they do their hands or legs. I know ſome have affirmed that they are apt to do ſo. But I have never found it true from my own obſervation, although I have taken pains to make obſervations of this kind, and have had good opportunities. I have likewiſe conſulted experienced midwives, mothers and nurſes, and found them agree, that they had never obſerved diſtortions of this kind in the eyes of children, but when they had reaſon to ſuſpect convulſions, or ſome preternatural cauſe.

It

It ſeems therefore to be extremely probable, that, previous to cuſtom, there is ſomething in the conſtitution, ſome natural inſtinct, which directs us to move both eyes always the ſame way.

We know not how the mind acts upon the body, nor by what power the muſcles are contracted and relaxed; but we ſee that in ſome of the voluntary, as well as in ſome of the involuntary motions, this power is ſo directed, that many muſcles which have no material tie or connection, act in concert, each of them being taught to play its part in exact time and meaſure. Nor doth a company of expert players in a theatrical performance, or of excellent muſicians in a concert, or of good dancers in a country-dance, with more regularity and order, conſpire and contribute their ſeveral parts, to produce one uniform effect, than a number of muſcles do, in many of the animal functions, and in many voluntary actions. Yet we ſee ſuch actions no leſs ſkilfully and regularly performed in children, and in thoſe who know not that they have ſuch muſcles, than in the moſt ſkilful anatomiſt and phyſiologiſt.

Who taught all the muſcles that are concerned in ſucking, in ſwallowing our food, in breathing,

breathing, and in the ſeveral natural expulſions, to act their part in ſuch regular order and exact meaſure? It was not cuſtom ſurely. It was that ſame powerful and wiſe Being who made the fabric of the human body, and fixed the laws by which the mind operates upon every part of it, ſo that they may anſwer the purpoſes intended by them. And when we ſee, in ſo many other inſtances, a ſyſtem of unconnected muſcles conſpiring ſo wonderfully in their ſeveral functions, without the aid of habit, it needs not be thought ſtrange, that the muſcles of the eye ſhould, without this aid, conſpire to give that direction to the eyes, without which they could not anſwer their end.

We ſee a like conſpiring action in the muſcles which contract the pupils of the two eyes; and in thoſe muſcles, whatever they be, by which the conformation of the eyes is varied, according to the diſtance of objects.

It ought however to be obſerved, that although it appears to be by natural inſtinct that both eyes are always turned the ſame way, there is ſtill ſome latitude left for cuſtom.

What we have ſaid of the parallel motion of the eyes, is not to be underſtood ſo ſtrictly,

as

as if nature directed us to keep their axes always preciſely and mathematically parallel to each other. Indeed, although they are always nearly parallel, they hardly ever are exactly ſo. When we look at an object, the axes of the eyes meet in that object; and therefore, make an angle, which is always ſmall, but will be greater or leſs, according as the object is nearer or more remote. Nature hath very wiſely left us the power of varying the parallelism of our eyes a little, ſo that we can direct them to the ſame point, whether remote or near. This, no doubt, is learned by cuſtom; and accordingly we ſee, that it is a long time before children get this habit in perfection.

This power of varying the parallelism of the eyes is naturally no more than is ſufficient for the purpoſe intended by it; but by much practice and ſtraining, it may be increaſed. Accordingly we ſee, that ſome have acquired the power of diſtorting their eyes into unnatural directions, as others have acquired the power of diſtorting their bodies into unnatural poſtures.

Thoſe who have loſt the ſight of an eye, commonly loſe what they had got by cuſtom, in the direction of their eyes, but retain what they

they had by nature; that is, although their eyes turn and move always together; yet, when they look upon an object, the blind eye will often have a very ſmall deviation from it; which is not perceived by a ſlight obſerver, but may be diſcerned by one accuſtomed to make exact obſervations in theſe matters.

SECT. XI.

Of our ſeeing objects erect by inverted images.

ANOTHER phenomenon which hath perplexed philoſophers, is, our ſeeing objects erect, when it is well known that their images or pictures upon the *tunica retina* of the eye are inverted.

The ſagacious KEPLER firſt made the noble diſcovery, That diſtinct but inverted pictures of viſible objects, are formed upon the *retina* by the rays of light coming from the object. The ſame great philoſopher demonſtrated from the principles of optics, how theſe pictures are formed,

formed, to-wit, That the rays coming from any one point of the object, and falling upon the various parts of the pupil, are, by the *cornea* and cryſtalline, refracted ſo as to meet again in one point of the *retina*, and there paint the colour of that point of the object from which they come. As the rays from different points of the object croſs each other before they come to the *retina*, the picture they form muſt be inverted; the upper part of the object being painted upon the lower part of the *retina*, the right ſide of the object upon the left of the *retina*, and ſo of the other parts.

This philoſopher thought that we ſee objects erect by means of theſe inverted pictures, for this reaſon, That as the rays from different points of the object croſs each other, before they fall upon the *retina*, we conclude that the impulſe which we feel upon the lower part of the *retina*, comes from above; and that the impulſe which we feel upon the higher part, comes from below.

Des Cartes afterwards gave the ſame ſolution of this phenomenon, and illuſtrated it by the judgment which we form of the poſition of objects which we feel with our arms croſſed,

croſſed, or with two ſticks that croſs each other.

But we cannot acquieſce in this ſolution. Firſt, Becauſe it ſuppoſes our ſeeing things erect, to be a deduction of reaſon, drawn from certain premiſes: whereas it ſeems to be an immediate perception. And, ſecondly, Becauſe the premiſes from which all mankind are ſuppoſed to draw this concluſion, never entered into the minds of the far greater part, but are abſolutely unknown to them. We have no feeling or perception of the pictures upon the *retina*, and as little ſurely of the poſition of them. In order to ſee objects erect, according to the principles of KEPLER or DES CARTES, we muſt previouſly know, that the rays of light come from the object to the eye in ſtraight lines; we muſt know, that the rays from different points of the object croſs one another, before they form the pictures upon the *retina*; and laſtly, we muſt know, that theſe pictures are really inverted. Now, although all theſe things are true, and known to philoſophers, yet they are abſolutely unknown to the far greateſt part of mankind: nor is it poſſible that they who are abſolutely ignorant of them, ſhould reaſon from them, and build concluſions upon them. Since therefore

therefore viſible objects appear erect to the ignorant as well as to the learned, this cannot be a concluſion drawn from premiſes which never entered into the minds of the ignorant. We have indeed had occaſion to obſerve many inſtances of concluſions drawn, either by means of original principles, or by habit, from premiſes which paſs through the mind very quickly, and which are never made the objects of reflection; but ſurely no man will conceive it poſſible to draw concluſions from premiſes which never entered into the mind at all.

Biſhop BERKELEY having juſtly rejected this ſolution, gives one founded upon his own principles; wherein he is followed by the judicious Dr SMITH in his Optics; and this we ſhall next explain and examine.

That ingenious writer conceives the ideas of ſight to be altogether unlike thoſe of touch. And ſince the notions we have of an object by theſe different ſenſes have no ſimilitude, we can learn only by experience how one ſenſe will be affected, by what, in a certain manner, affects the other. Figure, poſition, and even number, in tangible objects, are ideas of touch; and although there is no ſimilitude between theſe and the ideas of ſight, yet we

learn by experience, that a triangle affects the ſight in ſuch a manner, and that a ſquare affects it in ſuch another manner: hence we judge that which affects it in the firſt manner, to be a triangle, and that which affects it in the ſecond, to be a ſquare. In the ſame way, finding from experience, that an object in an erect poſition, affects the eye in one manner, and the ſame object in an inverted poſition, affects it in another, we learn to judge, by the manner in which the eye is affected, whether the object is erect or inverted. In a word, viſible ideas, according to this author, are ſigns of the tangible; and the mind paſſeth from the ſign to the thing ſignified, not by means of any ſimilitude between the one and the other, nor by any natural principle; but by having found them conſtantly conjoined in experience, as the ſounds of a language are with the things they ſignify. So that if the images upon the *retina* had been always erect, they would have ſhewn the objects erect, in the manner as they do now that they are inverted: nay, if the viſible idea which we now have from an inverted object, had been aſſociated from the beginning with the erect poſition of that object, it would have ſignified an erect poſition, as readily as it now ſignifies

an

an inverted one. And if the viſible appearance of two ſhillings had been found connected from the beginning with the tangible idea of one ſhilling, that appearance would as naturally and readily have ſignified the unity of the object, as now it ſignifies its duplicity.

This opinion is undoubtedly very ingenious; and, if it is juſt, ſerves to reſolve, not only the phenomenon now under conſideration, but likewiſe that which we ſhall next conſider, our ſeeing objects ſingle with two eyes.

It is evident, that in this ſolution it is ſuppoſed, that we do not originally, and previous to acquired habits, ſee things either erect or inverted, of one figure or another, ſingle or double, but learn from experience to judge of their tangible poſition, figure, and number, by certain viſible ſigns.

Indeed, it muſt be acknowledged to be extremely difficult to diſtinguiſh the immediate and natural objects of ſight, from the concluſions which we have been accuſtomed from infancy to draw from them. Biſhop BERKELEY was the firſt that attempted to diſtinguiſh the one from the other, and to trace out the boundary that divides them. And, if in doing ſo, he hath gone a little to the right-hand or to the left, this might be expected in a ſub-

ject altogether new, and of the greateſt ſubtilty. The nature of viſion hath received great light from this diſtinction; and many phenomena in optics, which before appeared altogether unaccountable, have been clearly and diſtinctly reſolved by it. It is natural, and almoſt unavoidable, to one who hath made an important diſcovery in philoſophy, to carry it a little beyond its ſphere, and to apply it to the reſolution of phenomena which do not fall within its province. Even the great NEWTON, when he had diſcovered the univerſal law of gravitation, and obſerved how many of the phenomena of nature depend upon this, and other laws of attraction and repulſion, could not help expreſſing his conjecture, that all the phenomena of the material world depend upon attracting and repelling forces in the particles of matter. And I ſuſpect that the ingenious Biſhop of Cloyne, having found ſo many phenomena of viſion reducible to the conſtant aſſociation of the ideas of ſight and touch, carried this principle a little beyond its juſt limits.

In order to judge, as well as we can, whether it is ſo, let us ſuppoſe ſuch a blind man as Dr SAUNDERSON, having all the knowledge and abilities which a blind man may have, ſuddenly

ſuddenly made to ſee perfectly. Let us ſuppoſe him kept from all opportunities of aſſociating his ideas of ſight with thoſe of touch, until the former become a little familiar; and the firſt ſurpriſe, occaſioned by objects ſo new, being abated, he has time to canvaſs them, and to compare them, in his mind, with the notions which he formerly had by touch; and in particular to compare, in his mind, that viſible extenſion which his eyes preſent, with the extenſion in length and breadth with which he was before acquainted.

We have endeavoured to prove, that a blind man may form a notion of the viſible extenſion and figure of bodies, from the relation which it bears to their tangible extenſion and figure. Much more, when this viſible extenſion and figure are preſented to his eye, will he be able to compare them with tangible extenſion and figure, and to perceive, that the one has length and breadth as well as the other; that the one may be bounded by lines, either ſtraight or curve, as well as the other. And therefore, he will perceive, that there may be viſible as well as tangible circles, triangles, quadrilateral and multilateral figures. And although the viſible figure is coloured, and the tangible is not, they may,

notwithſtanding, have the ſame figure; as two objects of touch may have the ſame figure, although one is hot and the other cold.

We have demonſtrated, that the properties of viſible figures differ from thoſe of the plain figures which they repreſent: but it was obſerved at the ſame time, that when the object is ſo ſmall as to be ſeen diſtinctly at one view, and is placed directly before the eye, the difference between the viſible and the tangible figure is too ſmall to be perceived by the ſenſes. Thus, it is true, that of every viſible triangle, the three angles are greater than two right angles; whereas, in a plain triangle, the three angles are equal to two right angles: but, when the viſible triangle is ſmall, its three angles will be ſo nearly equal to two right angles, that the ſenſe cannot diſcern the difference. In like manner, the circumferences of unequal viſible circles are not, but thoſe of plain circles are, in the *ratio* of their diameters; yet in ſmall viſible circles, the circumferences are very nearly in the *ratio* of their diameters; and the diameter bears the ſame *ratio* to the circumference, as in a plain circle, very nearly.

Hence it appears, that ſmall viſible figures (and ſuch only can be ſeen diſtinctly at one view)

view) have not only a reſemblance to the plain tangible figures which have the ſame name, but are to all ſenſe the ſame. So that if Dr SAUNDERSON had been made to ſee, and had attentively viewed the figures of the firſt book of EUCLID, he might, by thought and conſideration, without touching them, have found out that they were the very figures he was before ſo well acquainted with by touch.

When plain figures are ſeen obliquely, their viſible figure differs more from the tangible; and the repreſentation which is made to the eye, of ſolid figures, is ſtill more imperfect; becauſe viſible extenſion hath not three, but two dimenſions only. Yet, as it cannot be ſaid that an exact picture of a man hath no reſemblance of the man, or that a perſpective view of a houſe hath no reſemblance of the houſe; ſo it cannot be ſaid, with any propriety, that the viſible figure of a man, or of a houſe, hath no reſemblance of the objects which they repreſent.

Biſhop BERKELEY therefore proceeds upon a capital miſtake, in ſuppoſing that there is no reſemblance betwixt the extenſion, figure, and poſition which we ſee, and that which we perceive by touch.

We may further obſerve, that Biſhop BERKELEY's ſyſtem, with regard to material things, muſt have made him ſee this queſtion, of the erect appearance of objects, in a very different light from that in which it appears to thoſe who do not adopt his ſyſtem.

In his theory of viſion, he ſeems indeed to allow, that there is an external material world: but he believed that this external world is tangible only, and not viſible; and that the viſible world, the proper object of ſight, is not external, but in the mind. If this is ſuppoſed, he that affirms that he ſees things erect and not inverted, affirms that there is a top and a bottom, a right and a left in the mind. Now, I confeſs I am not ſo well acquainted with the topography of the mind, as to be able to affix a meaning to theſe words when applied to it.

We ſhall therefore allow, that if viſible objects were not external, but exiſted only in the mind, they could have no figure, or poſition, or extenſion; and that it would be abſurd to affirm, that they are ſeen either erect or inverted; or that there is any reſemblance between them and the objects of touch. But when we propoſe the queſtion, Why objects are ſeen erect and not inverted? we take it for

for granted, that we are not in Biſhop BERKELEY's ideal world, but in that world which men, who yield to the dictates of common ſenſe, believe themſelves to inhabit. We take it for granted, that the objects both of ſight and touch, are external, and have a certain figure, and a certain poſition with regard to one another, and with regard to our bodies, whether we perceive it or not.

When I hold my walking-cane upright in my hand, and look at it, I take it for granted, that I ſee and handle the ſame individual object. When I ſay that I feel it erect, my meaning is, that I feel the head directed from the horizon, and the point directed towards it: and when I ſay that I ſee it erect, I mean that I ſee it with the head directed from the horizon, and the point towards it. I conceive the horizon as a fixed object both of ſight and touch, with relation to which, objects are ſaid to be high or low, erect or inverted: and when the queſtion is aſked, Why I ſee the object erect, and not inverted? it is the ſame as if you ſhould aſk, Why I ſee it in that poſition which it really hath? or, Why the eye ſhows the real poſition of objects, and doth not ſhow them in an inverted poſition, as they are ſeen by a common aſtronomical teleſcope,

or

or as their pictures are ſeen upon the *retina* of an eye when it is diſſected.

SECT. XII.

The ſame ſubject continued.

IT is impoſſible to give a ſatisfactory anſwer to this queſtion, otherwiſe than by pointing out the laws of nature which take place in viſion; for by theſe the phenomena of viſion muſt be regulated.

Therefore I anſwer, Firſt, That by a law of nature the rays of light proceed from every point of the object to the pupil of the eye in ſtraight lines. Secondly, That by the laws of nature, the rays coming from any one point of the object to the various parts of the pupil, are ſo refracted, as to meet again in one point of the *retina;* and the rays from different points of the object, firſt croſſing each other, and then proceeding to as many different points of the *retina*, form an inverted picture of the object.

So

So far the principles of optics carry us; and experience further aſſures us, that if there is no ſuch picture upon the *retina*, there is no viſion; and that ſuch as the picture on the *retina* is, ſuch is the appearance of the object, in colour and figure, diſtinctneſs or indiſtinctneſs, brightneſs or faintneſs.

It is evident, therefore, that the pictures upon the *retina* are, by the laws of nature, a mean of viſion; but in what way they accompliſh their end, we are totally ignorant. Philoſophers conceive, that the impreſſion made on the *retina* by the rays of light, is communicated to the optic nerve, and by the optic nerve conveyed to ſome part of the brain, by them called the *ſenſorium*; and that the impreſſion thus conveyed to the *ſenſorium* is immediately perceived by the mind, which is ſuppoſed to reſide there. But we know nothing of the ſeat of the ſoul: and we are ſo far from perceiving immediately what is tranſacted in the brain, that of all parts of the human body we know leaſt about it. It is indeed very probable, that the optic nerve is an inſtrument of viſion no leſs neceſſary than the *retina*; and that ſome impreſſion is made upon it, by means of the pictures on the *retina*.

tina. But of what kind this impreſſion is, we know nothing.

There is not the leaſt probability, that there is any picture or image of the object either in the optic nerve or brain. The pictures on the *retina* are formed by the rays of light; and whether we ſuppoſe, with ſome, that their impulſe upon the *retina* cauſes ſome vibration of the fibres of the optic nerve; or, with others, that it gives motion to ſome ſubtile fluid contained in the nerve; neither that vibration, nor this motion, can reſemble the viſible object which is preſented to the mind. Nor is there any probability, that the mind perceives the pictures upon the *retina.* Theſe pictures are no more objects of our perception, than the brain is, or the optic nerve. No man ever ſaw the pictures in his own eye, nor indeed the pictures in the eye of another, until it was taken out of the head and duly prepared.

It is very ſtrange, that philoſophers, of all ages, ſhould have agreed in this notion, That the images of external objects are conveyed by the organs of ſenſe to the brain, and are there perceived by the mind. Nothing can be more unphiloſophical. For, firſt, This notion hath no foundation in fact and obſervation.

vation. Of all the organs of ſenſe, the eye only, as far as we can diſcover, forms any kind of image of its object; and the images formed by the eye are not in the brain, but only in the bottom of the eye; nor are they at all perceived or felt by the mind. Secondly, It is as difficult to conceive how the mind perceives images in the brain, as how it perceives things more diſtant. If any man will ſhew how the mind may perceive images in the brain, I will undertake to ſhew how it may perceive the moſt diſtant objects: for if we give eyes to the mind, to perceive what is tranſacted at home in its dark chamber, why may we not make theſe eyes a little longer ſighted? and then we ſhall have no occaſion for that unphiloſophical fiction of images in the brain. In a word, the manner and mechaniſm of the mind's perception is quite beyond our comprehenſion: and this way of explaining it by images in the brain, ſeems to be founded upon very groſs notions of the mind and its operations; as if the ſuppoſed images in the brain, by a kind of contact, formed ſimilar impreſſions or images of objects upon the mind, of which impreſſions it is ſuppoſed to be conſcious.

We

We have endeavoured to ſhew, throughout the courſe of this inquiry, that the impreſſions made upon the mind by means of the five ſenſes, have not the leaſt reſemblance to the objects of ſenſe: and therefore, as we ſee no ſhadow of evidence, that there are any ſuch images in the brain, ſo we ſee no purpoſe, in philoſophy, that the ſuppoſition of them can anſwer. Since the picture upon the *retina*, therefore, is neither itſelf ſeen by the mind, nor produces any impreſſion upon the brain or *ſenſoriam*, which is ſeen by the mind, nor makes any impreſſion upon the mind that reſembles the object, it may ſtill be aſked, How this picture upon the *retina* cauſes viſion?

Before we anſwer this queſtion, it is proper to obſerve, that in the operations of the mind, as well as in thoſe of bodies, we muſt often be ſatisfied with knowing, that certain things are connected, and invariably follow one another, without being able to diſcover the chain that goes between them. It is to ſuch connections that we give the name of *laws of nature*; and when we ſay that one thing produces another by a law of nature, this ſignifies no more, but that one thing, which we call in popular language *the cauſe*, is conſtantly and invariably followed

followed by another, which we call *the effect;* and that we know not how they are connected. Thus, we ſee it is a fact, that bodies gravitate towards bodies; and that this gravitation is regulated by certain mathematical proportions, according to the diſtances of the bodies from each other, and their quantities of matter. Being unable to diſcover the cauſe of this gravitation, and preſuming that it is the immediate operation, either of the Author of nature, or of ſome ſubordinate cauſe, which we have not hitherto been able to reach, we call it *a law of nature.* If any philoſopher ſhould hereafter be ſo happy as to diſcover the cauſe of gravitation, this can only be done by diſcovering ſome more general law of nature, of which the gravitation of bodies is a neceſſary conſequence. In every chain of natural cauſes, the higheſt link is a primary law of nature, and the higheſt link which we can trace, by juſt induction, is either this primary law of nature, or a neceſſary conſequence of it. To trace out the laws of nature, by induction, from the phenomena of nature, is all that true philoſophy aims at, and all that it can ever reach.

There are laws of nature by which the operations of the mind are regulated; there are alſo

alſo laws of nature that govern the material ſyſtem: and as the latter are the ultimate concluſions which the human faculties can reach in the philoſophy of bodies, ſo the former are the ultimate concluſions we can reach in the philoſophy of minds.

To return, therefore, to the queſtion above propoſed, we may ſee, from what hath been juſt now obſerved, that it amounts to this, By what law of nature is a picture upon the *retina*, the mean or occaſion of my ſeeing an external object of the ſame figure and colour, in a contrary poſition, and in a certain direction from the eye?

It will, without doubt, be allowed, that I ſee the whole object in the ſame manner and by the ſame law by which I ſee any one point of it. Now, I know it to be a fact, that, in direct viſion, I ſee every point of the object in the direction of the right line that paſſeth from the centre of the eye to that point of the object: and I know likewiſe, from optics, that the ray of light that comes to the centre of my eye, paſſes on to the *retina* in the ſame direction. Hence it appears to be a fact, that every point of the object is ſeen in the direction of a right line paſſing from the picture of that point on the *retina* through the centre of the

the eye. As this is a fact that holds univerſally and invariably, it muſt either be a law of nature, or the neceſſary conſequence of ſome more general law of nature. And according to the juſt rules of philoſophizing, we may hold it for a law of nature, until ſome more general law be diſcovered, whereof it is a neceſſary conſequence, which I ſuſpect can never be done.

Thus we ſee, that the phenomena of viſion lead us by the hand to a law of nature, or a law of our conſtitution, of which law our ſeeing objects erect by inverted images, is a neceſſary conſequence. For it neceſſarily follows, from the law we have mentioned, that the object whoſe picture is loweſt on the *retina*, muſt be ſeen in the higheſt direction from the eye; and that the object whoſe picture is on the right of the *retina*, muſt be ſeen on the left; ſo that if the pictures had been erect in the *retina*, we ſhould have ſeen the object inverted. My chief intention in handling this queſtion, was to point out this law of nature; which, as it is a part of the conſtitution of the human mind, belongs properly to the ſubject of this inquiry. For this reaſon I ſhall make ſome further remarks upon it, after doing juſtice to the ingenious Dr PORTER-

FIELD, who, long ago in the Medical Eſſays, or more lately in his Treatiſe of the Eye, pointed out, as a primary law of our nature, That a viſible object appears in the direction of a right line perpendicular to the *retina* at that point where its image is painted. If lines drawn from the centre of the eye to all parts of the *retina* be perpendicular to it, as they muſt be very nearly, this coincides with the law we have mentioned, and is the ſame in other words. In order, therefore, that we may have a more diſtinct notion of this law of our conſtitution, we may obſerve,

1. That we can give no reaſon why the *retina* is, of all parts of the body, the only one on which pictures made by the rays of light cauſe viſion; and therefore we muſt reſolve this ſolely into a law of our conſtitution. We may form ſuch pictures by means of optical glaſſes, upon the hand, or upon any other part of the body; but they are not felt, nor do they produce any thing like viſion. A picture upon the *retina* is as little felt as one upon the hand; but it produces viſion; for no other reaſon that we know, but becauſe it is deſtined by the wiſdom of nature to this purpoſe. The vibrations of the air ſtrike upon the eye, the palate, and the olfactory membrane,

brane, with the ſame force as upon the *membrani tympani* of the ear: The impreſſion they make upon the laſt, produces the ſenſation of ſound; but their impreſſions upon any of the former, produces no ſenſation at all. This may be extended to all the ſenſes, whereof each hath its peculiar laws, according to which, the impreſſions made upon the organ of that ſenſe, produce ſenſations or perceptions in the mind, that cannot be produced by impreſſions made upon any other organ.

2. We may obſerve, that the laws of perception, by the different ſenſes, are very different, not only in reſpect of the nature of the objects perceived by them, but likewiſe in reſpect of the notices they give us of the diſtance and ſituation of the object. In all of them the object is conceived to be external, and to have real exiſtence, independent of our perception: but in one, the diſtance, figure and ſituation of the object, are all preſented to the mind; in another, the figure and ſituation, but not the diſtance; and in others, neither figure, ſituation, nor diſtance. In vain do we attempt to account for theſe varieties in the manner of perception by the different ſenſes, from principles of anatomy or natural philoſophy. They muſt at laſt be reſolved in-

to the will of our Maker, who intended that our powers of perception ſhould have certain limits, and adapted the organs of perception, and the laws of nature by which they operate, to his wiſe purpoſes.

When we hear an unuſual ſound, the ſenſation indeed is in the mind, but we know that there is ſomething external that produced this ſound. At the ſame time, our hearing does not inform us, whether the ſounding body is near or at a diſtance, in this direction or that; and therefore we look round to diſcover it.

If any new phenomenon appears in the heavens, we ſee exactly its colour, its apparent place, magnitude, and figure, but we ſee not its diſtance. It may be in the atmoſphere, it may be among the planets, or it may be in the ſphere of the fixed ſtars, for any thing the eye can determine.

The teſtimony of the ſenſe of touch reaches only to objects that are contiguous to the organ, but with regard to them, is more preciſe and determinate. When we feel a body with our hand, we know the figure, diſtance, and poſition of it, as well as whether it is rough or ſmooth, hard or ſoft, hot or cold.

The

The ſenſations of touch, of ſeeing, and hearing, are all in the mind, and can have no exiſtence but when they are perceived. How do they all conſtantly and invariably ſuggeſt the conception and belief of external objects, which exiſt whether they are perceived or not? No philoſopher can give any other anſwer to this, but that ſuch is the conſtitution of our nature. How do we know, that the object of touch is at the fingers end, and no where elſe? That the object of ſight is in ſuch a direction from the eye, and in no other, but may be at any diſtance? and that the object of hearing may be at any diſtance, and in any direction? Not by cuſtom ſurely; not by reaſoning, or comparing ideas, but by the conſtitution of our nature. How do we perceive viſible objects in the direction of right lines perpendicular to that part of the *retina* on which the rays ſtrike, while we do not perceive the objects of hearing in lines perpendicular to the *membrana tympani*, upon which the vibrations of the air ſtrike? Becauſe ſuch are the laws of our nature. How do we know the parts of our bodies affected by particular pains? Not by experience or by reaſoning, but by the conſtitution of nature. The ſenſation of pain is, no doubt, in the mind, and

cannot be ſaid to have any relation, from its own nature, to any part of the body: but this ſenſation, by our conſtitution, gives a perception of ſome particular part of the body, whoſe diſorder cauſes the uneaſy ſenſation. If it were not ſo, a man who never before felt either the gout or the toothach, when he is firſt ſeized with the gout in his toe, might miſtake it for the toothach.

Every ſenſe, therefore, hath its peculiar laws and limits, by the conſtitution of our nature; and one of the laws of ſight is, that we always ſee an object in the direction of a right line paſſing from its image on the *retina* through the centre of the eye.

3. Perhaps ſome readers will imagine, that it is eaſier, and will anſwer the purpoſe as well, to conceive a law of nature, by which we ſhall always ſee objects in the place in which they are, and in their true poſition, without having recourſe to images on the *retina*, or to the optical centre of the eye.

To this I anſwer, that nothing can be a law of nature which is contrary to fact. The laws of nature are the moſt general facts we can diſcover in the operations of nature. Like other facts, they are not to be hit upon by a happy conjecture, but juſtly deduced from obſervation:

tion: Like other general facts, they are not to be drawn from a few particulars, but from a copious, patient, and cautious induction. That we see thing always in their true place and position, is not fact; and therefore it can be no law of nature. In a plain mirror, I see myself, and other things, in places very different from those they really occupy. And so it happens in every instance, wherein the rays coming from the object are either reflected or refracted before falling upon the eye. Those who know any thing of optics, know that, in all such cases, the object is seen in the direction of a line passing from the centre of the eye, to the point where the rays were last reflected or refracted; and that upon this all the powers of the telescope and microscope depend.

Shall we say, then, that it is a law of nature, that the object is seen in the direction which the rays have when they fall on the eye, or rather in the direction contrary to that of the rays when they fall upon the eye? No. This is not true, and therefore it is no law of nature. For the rays, from any one point of the object, come to all parts of the pupil; and therefore must have different directions: but we see the object only in one of these direc-

tions, to wit, in the direction of the rays that come to the centre of the eye. And this holds true, even when the rays that ſhould paſs through the centre are ſtopt, and the object is ſeen by rays that paſs at a diſtance from the centre.

Perhaps it may ſtill be imagined, that although we are not made ſo as to ſee objects always in their true place, nor ſo as to ſee them preciſely in the direction of the rays when they fall upon the *cornea*; yet we may be ſo made, as to ſee the object in the direction which the rays have when they fall upon the *retina*, after they have undergone all their refractions in the eye, that is, in the direction in which the rays paſs from the cryſtalline to the *retina*. But neither is this true; and conſequently it is no law of our conſtitution. In order to ſee that it is not true, we muſt conceive all the rays that paſs from the cryſtalline to one point of the *retina*, as forming a ſmall cone, whoſe baſe is upon the back of the cryſtalline, and whoſe vertex is a point of the *retina*. It is evident that the rays which form the picture in this point, have various directions, even after they paſs the cryſtalline; yet the object is ſeen only in one of theſe directions, to-wit, in the direction

direction of the rays that come from the centre of the eye. Nor is this owing to any particular virtue in the central rays, or in the centre itſelf; for the central rays may be ſtopt. When they are ſtopt, the image will be formed upon the ſame point of the *retina* as before, by rays that are not central, nor have the ſame direction which the central rays had: and in this caſe the object is ſeen in the ſame direction as before, although there are now no rays coming in that direction.

From this induction we conclude, That our ſeeing an object in that particular direction in which we do ſee it, is not owing to any law of nature by which we are made to ſee it in the direction of the rays, either before their refractions in the eye, or after, but to a law of our nature, by which we ſee the object in the direction of the right line that paſſeth from the picture of the object upon the *retina* to the centre of the eye.

The facts upon which I ground this induction, are taken from ſome curious experiments of SCHEINER, in his *Fundament. Optic.*, quoted by Dr PORTERFIELD, and confirmed by his experience. I have alſo repeated theſe experiments, and found them to anſwer. As they are eaſily made, and tend to illuſtrate and

and confirm the law of nature I have mentioned, I ſhall recite them as briefly and diſtinctly as I can.

Experiment 1. Let a very ſmall object, ſuch as the head of a pin, well illuminated, be fixed at ſuch a diſtance from the eye, as to be beyond the neareſt limit, and within the fartheſt limit of diſtinct viſion: For a young eye, not near-ſighted, the object may be placed at the diſtance of eighteen inches. Let the eye be kept ſteadily in one place, and take a diſtinct view of the object. We know from the principles of optics, that the rays from any one point of this object, whether they paſs through the centre of the eye, or at any diſtance from the centre which the breadth of the pupil will permit, do all unite again in one point of the *retina*. We know alſo, that theſe rays have different directions, both before they fall upon the eye, and after they paſs through the cryſtalline.

Now, we can ſee the object by any one ſmall parcel of theſe rays, excluding the reſt, by looking though a ſmall pin-hole in a card. Moving this pin-hole over the various parts of the pupil, we can ſee the object, firſt by the rays that paſs above the centre of the eye, then by the central rays, then by the rays that paſs

paſs below the centre, and in like manner by the rays that paſs on the right and left of the centre. Thus, we view this object, ſucceſſively, by rays that are central, and by rays that are not central; by rays that have different directions, and are variouſly inclined to each other, both when they fall upon the *cornea*, and when they fall upon the *retina*; but always, by rays which fall upon the ſame point of the *retina*. And what is the event? It is this, that the object is ſeen in the ſame individual direction, whether ſeen by all theſe rays together, or by any one parcel of them.

Experiment 2. Let the object above mentioned be now placed within the neareſt limit of diſtinct viſion, that is, for an eye that is not near-ſighted, at the diſtance of four or five inches. We know, that in this caſe, the rays coming from one point of the object, do not meet in one point of the *retina*, but ſpread over a ſmall circular ſpot of it; the central rays occupying the centre of this circle, the rays that paſs above the centre occupying the upper part of the circular ſpot, and ſo of the reſt. And we know that the object is in this caſe ſeen confuſed, every point of it being ſeen, not in one, but in various directions.

To

To remedy this confuſion, we look at the object through the pin-hole, and while we move the pin hole over the various parts of the pupil, the object does not keep its place, but ſeems to move in a contrary direction.

It is here to be obſerved, that when the pin-hole is carried upwards over the pupil, the picture of the object is carried upwards upon the *retina*, and the object at the ſame time ſeems to move downwards, ſo as to be always in the right line paſſing from the picture through the centre of the eye. It is likewiſe to be obſerved, that the rays which form the upper and the lower pictures upon the *retina*, do not croſs each other as in ordinary viſion; yet ſtill the higher picture ſhews the object lower, and the lower picture ſhews the object higher, in the ſame manner as when the rays croſs each other. Whence we may obſerve, by the way, that this phenomenon of our ſeeing objects in a poſition contrary to that of their pictures upon the *retina*, does not depend upon the croſſing of the rays, as KEPLER and DES CARTES conceived.

Experiment 3. Other things remaining as in the laſt experiment, make three pin-holes in a ſtraight line, ſo near, that the rays coming from the object through all the holes, may enter

enter the pupil at the ſame time. In this caſe we have a very curious phenomenon; for the object is ſeen triple with one eye. And if you make more holes within the breadth of the pupil, you will ſee as many objects as there are holes. However, we ſhall ſuppoſe them only three; one on the right, one in the middle, and one on the left; in which caſe, you ſee three objects ſtanding in a line from right to left.

It is here to be obſerved, that there are three pictures on the *retina;* that on the left being formed by the rays which paſs on the left of the eye's centre; the middle picture being formed by the central rays, and the right-hand picture by the rays which paſs on the right of the eye's centre. It is farther to be obſerved, that the object which appears on the right, is not that which is ſeen through the hole on the right, but that which is ſeen through the hole on the left; and in like manner, the left-hand object is ſeen through the hole on the right, as is eaſily proved by covering the holes ſucceſſively. So that, whatever is the direction of the rays which form the right-hand and left-hand pictures, ſtill the right-hand picture ſhows a left-hand object,

object, and the left-hand picture ſhows a right-hand object.

Experiment 4. It is eaſy to ſee how the two laſt experiments may be varied, by placing the object beyond the fartheſt limit of diſtinct viſion. In order to make this experiment, I looked at a candle at the diſtance of ten feet, and put the eye of my ſpectacles behind the card, that the rays from the ſame point of the object might meet, and croſs each other, before they reached the *retina*. In this caſe, as in the former, the candle was ſeen triple through the three pin-holes; but the candle on the right, was ſeen through the hole on the right; and, on the contrary, the left-hand candle was ſeen through the hole on the left. In this experiment, it is evident from the principles of optics, that the rays forming the ſeveral pictures on the *retina*, croſs each other a little before they reach the *retina*; and therefore the left-hand picture is formed by the rays which paſs through the hole on the right: ſo that the poſition of the pictures is contrary to that of the holes by which they are formed; and therefore is alſo contrary to that of their objects, as we have found it to be in the former experiments.

Theſe

Theſe experiments exhibit ſeveral uncommon phenomena, that regard the apparent place, and the direction of viſible objects from the eye; phenomena that ſeem to be moſt contrary to the common rules of viſion. When we look at the ſame time through three holes that are in a right line, and at certain diſtances from each other, we expect, that the objects ſeen through them ſhould really be, and ſhould appear to be, at a diſtance from each other: Yet, by the firſt experiment, we may, through three ſuch holes, ſee the ſame object, and the ſame point of that object; and through all the three it appears in the ſame individual place and direction.

When the rays of light come from the object in right lines to the eye, without any reflection, inflection, or refraction, we expect, that the object ſhould appear in its real and proper direction from the eye; and ſo it commonly does: But in the ſecond, third, and fourth experiments, we ſee the object in a direction which is not its true and real direction from the eye, although the rays come from the object to the eye, without any inflection, reflection, or refraction.

When both the object and the eye are fixed without the leaſt motion, and the medium unchanged,

unchanged, we expect, that the object ſhould appear to reſt, and keep the ſame place: Yet in the ſecond and fourth experiments, when both the eye and the object are at reſt, and the medium unchanged, we make the object appear to move upwards or downwards, or in any direction we pleaſe.

When we look at the ſame time, and with the ſame eye, through holes that ſtand in a line from right to left, we expect, that the object ſeen through the left-hand hole ſhould appear on the left, and the object ſeen through the right-hand hole, ſhould appear on the right: Yet in the third experiment, we find the direct contrary.

Although many inſtances occur in ſeeing the ſame object double with two eyes, we always expect, that it ſhould appear ſingle when ſeen only by one eye: Yet in the ſecond and fourth experiments, we have inſtances wherein the ſame object may appear double, triple, or quadruple to one eye, without the help of a polyhedron or multiplying glaſs.

All theſe extraordinary phenomena, regarding the direction of viſible objects from the eye, as well as thoſe that are common and ordinary, lead us to that law of nature which I have mentioned, and are the neceſſary conſequences

quences of it. And, as there is no probability that we ſhall ever be able to give a reaſon why pictures upon the *retina* make us ſee external objects, any more than pictures upon the hand or upon the cheek; or, that we ſhall ever be able to give a reaſon, why we ſee the object in the direction of a line paſſing from its picture through the centre of the eye, rather than in any other direction: I am therefore apt to look upon this law as a primary law of our conſtitution.

To prevent being miſunderſtood, I beg the reader to obſerve, that I do not mean to affirm, that the picture upon the *retina* will make us ſee an object in the direction mentioned, or in any direction, unleſs the optic nerve, and the other more immediate inſtruments of viſion, be ſound, and perform their function. We know not well what is the office of the optic nerve, nor in what manner it performs that office; but that it hath ſome part in the faculty of ſeeing, ſeems to be certain; becauſe in an *amauroſis*, which is believed to be a diſorder of the optic nerve, the pictures on the *retina* are clear and diſtinct, and yet there is no viſion.

We know ſtill leſs of the uſe and function of the choroid membrane; but it ſeems like-

wiſe to be neceſſary to viſion: for it is well known, that pictures upon that part of the *retina* where it is not covered by the choroid, I mean at the entrance of the optic nerve, produce no viſion, any more than a picture upon the hand. We acknowledge, therefore, that the *retina* is not the laſt and moſt immediate inſtrument of the mind in viſion. There are other material organs, whoſe operation is neceſſary to ſeeing, even after the pictures upon the *retina* are formed. If ever we come to know the ſtructure and uſe of the choroid membrane, the optic nerve, and the brain, and what impreſſions are made upon them by means of the pictures on the *retina*, ſome more links of the chain may be brought within our view, and a more general law of viſion diſcovered: but while we know ſo little of the nature and office of theſe more immediate inſtruments of viſion, it ſeems to be impoſſible to trace its laws beyond the pictures upon the *retina*.

Neither do I pretend to ſay, that there may not be diſeaſes of the eye, or accidents, which may occaſion our ſeeing objects in a direction ſomewhat different from that mentioned above. I ſhall beg leave to mention one inſtance of this kind that concerns myſelf.

In

In May 1761, being occupied in making an exact meridian, in order to obſerve the tranſit of Venus, I raſhly directed to the ſun, by my right eye, the croſs hairs of a ſmall teleſcope. I had often done the like in my younger days with impunity; but I ſuffered by it at laſt, which I mention as a warning to others.

I ſoon obſerved a remarkable dimneſs in that eye; and for many weeks, when I was in the dark, or ſhut my eyes, there appeared before the right eye a lucid ſpot, which trembled much like the image of the ſun ſeen by reflection from water. This appearance grew fainter, and leſs frequent by degrees; ſo that now there are ſeldom any remains of it. But ſome other very ſenſible effects of this hurt ſtill remain. For, firſt, The ſight of the right eye continues to be more dim than that of the left. Secondly, The neareſt limit of diſtinct viſion is more remote in the right eye than in the other; although, before the time mentioned, they were equal in both theſe reſpects, as I had found by many trials. But, thirdly, what I chiefly intended to mention, is, That a ſtraight line, in ſome circumſtances, appears to the right eye to have a curvature in it. Thus, when I look upon a muſic-book, and,

ſhutting my left eye, direct the right to a point of the middle line of the five which compoſe the ſtaff of muſic; the middle line appears dim, indeed, at the point to which the eye is directed, but ſtraight; at the ſame time the two lines above it, and the two below it, appear to be bent outwards, and to be more diſtant from each other, and from the middle line, than at other parts of the ſtaff, to which the eye is not directed. Fourthly, Although I have repeated this experiment times innumerable, within theſe ſixteen months, I do not find that cuſtom and experience takes away this appearance of curvature in ſtraight lines. Laſtly, This appearance of curvature is perceptible when I look with the right eye only, but not when I look with both eyes; yet I ſee better with both eyes together, than even with the left eye alone.

I have related this fact minutely as it is, without regard to any hypotheſis; becauſe I think ſuch uncommon facts deſerve to be recorded. I ſhall leave it to others to conjecture the cauſe of this appearance. To me it ſeems moſt probable, that a ſmall part of the *retina* towards the centre is ſhrunk, and that thereby the contiguous parts are drawn nearer to the centre, and to one another, than they were

were before; and that objects whose images fall on these parts, appear at that distance from each other which corresponds, not to the interval of the parts in their present preternatural contraction, but to their interval in their natural and sound state.

SECT. XIII.

Of seeing objects single with two eyes.

ANOTHER phenomenon of vision which deserves attention, is our seeing objects single with two eyes. There are two pictures of the object, one on each *retina*; and each picture by itself makes us see an object in a certain direction from the eye: yet both together commonly make us see only one object. All the accounts or solutions of this phenomenon given by anatomists and philosophers, seem to be unsatisfactory. I shall pass over the opinions of GALEN, of GASSENDUS, of BAPTISTA PORTA, and of ROHAULT. The reader may see these examined and refuted by Dr

PORTERFIELD. I ſhall examine Dr PORTERFIELD's own opinion, Biſhop BERKELEY's, and ſome others. But it will be neceſſary firſt to aſcertain the facts; for if we miſtake the phenomena of ſingle and double viſion, it is ten to one but this miſtake will lead us wrong in aſſigning the cauſes. This likewiſe we ought carefully to attend to, which is acknowledged in theory by all who have any true judgment or juſt taſte in inquiries of this nature, but is very often overlooked in practice, namely, That in the ſolution of natural phenomena, all the length that the human faculties can carry us, is only this, that from particular phenomena, we may, by induction, trace out general phenomena, of which all the particular ones are neceſſary conſequences. And when we have arrived at the moſt general phenomena we can reach, there we muſt ſtop. If it is aſked, Why ſuch a body gravitates towards the earth? all the anſwer that can be given, is, Becauſe all bodies gravitate towards the earth. This is reſolving a particular phenomenon into a general one. If it ſhould again be aſked, Why do all bodies gravitate towards the earth? we can give no other ſolution of this phenomenon, but that all bodies whatſoever gravitate towards each other.

This

This is reſolving a general phenomenon into a more general one. If it ſhould be aſked, Why all bodies gravitate to one another? we cannot tell; but if we could tell, it could only be by reſolving this univerſal gravitation of bodies into ſome other phenomenon ſtill more general, and of which the gravitation of all bodies is a particular inſtance. The moſt general phenomena we can reach, are what we call *laws of nature*. So that the laws of nature are nothing elſe but the moſt general facts relating to the operations of nature, which include a great many particular facts under them. And if in any caſe we ſhould give the name of a law of nature to a general phenomenon, which human induſtry ſhall afterwards trace to one more general, there is no great harm done. The moſt general aſſumes the name of a law of nature when it is diſcovered; and the leſs general is contained and comprehended in it. Having premiſed theſe things, we proceed to conſider the phenomena of ſingle and double viſion, in order to diſcover ſome general principle to which they all lead, and of which they are the neceſſary conſequences. If we can diſcover any ſuch general principle, it muſt either be a law of nature, or the neceſſary conſequence of ſome

law of nature; and its authority will be equal, whether it is the firſt or the laſt.

1. We find, that when the eyes are ſound and perfect, and the axes of both directed to one point, an object placed in that point is ſeen ſingle; and here we obſerve, that in this caſe the two pictures which ſhow the object ſingle, are in the centres of the *retina*. When two pictures of a ſmall object are formed upon points of the *retina*, if they ſhow the object ſingle, we ſhall, for the ſake of perſpicuity, call ſuch two points of the *retina*, *correſponding points*; and where the object is ſeen double, we ſhall call the points of the *retina* on which the pictures are formed, *points that do not correſpond*. Now, in this firſt phenomenon it is evident, that the two centres of the *retina* are correſponding points.

2. Suppoſing the ſame things as in the laſt phenomenon, other objects at the ſame diſtance from the eyes as that to which their axes are directed, do alſo appear ſingle. Thus, if I direct my eyes to a candle placed at the diſtance of ten feet; and, while I look at this candle, another ſtands at the ſame diſtance from my eyes, within the field of viſion; I can, while I look at the firſt candle, attend to the appearance which the ſecond makes to the

the eye; and I find that in this caſe it always appears ſingle. It is here to be obſerved, that the pictures of the ſecond candle do not fall upon the centres of the *retinæ*, but they both fall upon the ſame ſide of the centres, that is, both to the right, or both to the left, and both are at the ſame diſtance from the centres. This might eaſily be demonſtrated from the principles of optics. Hence it appears, that in this ſecond phenomenon of ſingle viſion, the correſponding points are points of the two *retinæ*, which are ſimilarly ſituate with reſpect to the two centres, being both upon the ſame ſide of the centre, and at the ſame diſtance from it. It appears likewiſe from this phenomenon, that every point in one *retina* correſponds with that which is ſimilarly ſituate in the other.

3. Suppoſing ſtill the ſame things, objects which are much nearer to the eyes, or much more diſtant from them, than that to which the two eyes are directed, appear double. Thus, if the candle is placed at the diſtance of ten feet, and I hold my finger at arms-length between my eyes and the candle; when I look at the candle, I ſee my finger double; and when I look at my finger, I ſee the candle double: And the ſame thing happens with

with regard to all other objects at like diſtances, which fall within the ſphere of viſion. In this phenomenon, it is evident to thoſe who underſtand the principles of optics, that the pictures of the objects which are ſeen double, do not fall upon points of the *retinæ* which are ſimilarly ſituate, but that the pictures of the objects ſeen ſingle do fall upon points ſimilarly ſituate. Whence we infer, that as the points of the two *retinæ*, which are ſimilarly ſituate with regard to the centres, do correſpond, ſo thoſe which are diſſimilarly ſituate do not correſpond.

4. It is to be obſerved, that although, in ſuch caſes as are mentioned in the laſt phenomenon, we have been accuſtomed from infancy to ſee objects double which we know to be ſingle; yet cuſtom, and experience of the unity of the object, never take away this appearance of duplicity.

5. It may however be remarked, that the cuſtom of attending to viſible appearances has a conſiderable effect, and makes the phenomenon of double viſion to be more or leſs obſerved and remembered. Thus you may find a man that can ſay with a good conſcience, that he never ſaw things double all his life; yet this very man, put in the ſituation above mentioned,

mentioned, with his finger between him and the candle, and desired to attend to the appearance of the object which he does not look at, will, upon the first trial, see the candle double, when he looks at his finger; and his finger double, when he looks at the candle. Does he now see otherwise than he saw before? No, surely; but he now attends to what he never attended to before. The same double appearance of an object hath been a thousand times presented to his eye before now; but he did not attend to it; and so it is as little an object of his reflection and memory, as if it had never happened.

When we look at an object, the circumjacent objects may be seen at the same time, although more obscurely and indistinctly: for the eye hath a considerable field of vision, which it takes in at once. But we attend only to the object we look at. The other objects which fall within the field of vision, are not attended to; and therefore are as if they were not seen. If any of them draws our attention, it naturally draws the eyes at the same time: for in the common course of life, the eyes always follow the attention: or if, at any time, in a reverie, they are separated from it, we hardly at that time see what is directly before

before us. Hence we may ſee the reaſon, why the man we are ſpeaking of thinks that he never before ſaw an object double. When he looks at any object, he ſees it ſingle, and takes no notice of other viſible objects at that time, whether they appear ſingle or double. If any of them draws his attention, it draws his eyes at the ſame time; and as ſoon as the eyes are turned towards it, it appears ſingle. But in order to ſee things double, at leaſt in order to have any reflection or remembrance that he did ſo, it is neceſſary that he ſhould look at one object, and at the ſame time attend to the faint appearance of other objects which are within the field of viſion. This is a practice which perhaps he never uſed, nor attempted; and therefore he does not recollect that ever he ſaw an object double. But when he is put upon giving this attention, he immediately ſees objects double in the ſame manner, and with the very ſame circumſtances, as they who have been accuſtomed, for the greateſt part of their lives, to give this attention.

There are many phenomena of a ſimilar nature, which ſhew, that the mind may not attend to, and thereby, in ſome ſort, not perceive, objects that ſtrike the ſenſes. I had occaſion

occaſion to mention ſeveral inſtances of this in the ſecond chapter; and I have been aſſured, by perſons of the beſt ſkill in muſic, that in hearing a tune upon the harpſichord, when they give attention to the treble, they do not hear the baſs; and when they attend to the baſs, they do not perceive the air of the treble. Some perſons are ſo near-ſighted, that, in reading, they hold the book to one eye, while the other is directed to other objects. Such perſons acquire the habit of attending, in this caſe, to the objects of one eye, while they give no attention to thoſe of the other.

6. It is obſervable, that in all caſes wherein we ſee an object double, the two appearances have a certain poſition with regard to one another, and a certain apparent or angular diſtance. This apparent diſtance is greater or leſs in different circumſtances; but in the ſame circumſtances, it is always the ſame, not only to the ſame, but to different perſons.

Thus, in the experiment above mentioned, if twenty different perſons, who ſee perfectly with both eyes, ſhall place their finger and the candle at the diſtances above expreſſed, and hold their heads upright; looking at the finger, they will ſee two candles, one on the right,

right, another on the left. That which is ſeen on the right, is ſeen by the right eye, and that which is ſeen on the left, by the left eye; and they will ſee them at the ſame apparent diſtance from each other. If again they look at the candle, they will ſee two fingers, one on the right, and the other on the left; and all will ſee them at the ſame apparent diſtance; the finger towards the left being ſeen by the right eye, and the other by the left. If the head is laid horizontally to one ſide, other circumſtances remaining the ſame, one appearance of the object ſeen double, will be directly above the other. In a word, vary the circumſtances as you pleaſe, and the appearances are varied to all the ſpectators in one and the ſame manner.

7. Having made many experiments in order to aſcertain the apparent diſtance of the two appearances of an object ſeen double, I have found that in all caſes this apparent diſtance is proportioned to the diſtance between the point of the *retina*, where the picture is made in one eye, and the point which is ſituated ſimilarly to that on which the picture is made on the other eye. So that as the apparent diſtance of two objects ſeen with one eye, is proportioned to the arch of the *retina*, which

which lies between their pictures: in like manner, when an object is ſeen double with the two eyes, the apparent diſtance of the two appearances is proportioned to the arch of either *retina*, which lies between the picture in that *retina*, and the point correſponding to that of the picture in the other *retina*.

8. As in certain circumſtances we invariably ſee one object appear double, ſo in others we as invariably ſee two objects unite into one; and, in appearance, loſe their duplicity. This is evident in the appearance of the binocular teleſcope. And the ſame thing happens when any two ſimilar tubes are applied to the two eyes in a parallel direction; for in this caſe we ſee only one tube. And if two ſhillings are placed at the extremities of the two tubes, one exactly in the axis of one eye, and the other in the axis of the other eye, we ſhall ſee but one ſhilling. If two pieces of coin, or other bodies, of different colour, and of different figure, be properly placed in the two axes of the eyes, and at the extremities of the tubes, we ſhall ſee both the bodies in one and the ſame place, each as it were ſpread over the other, without hiding it; and the colour will be that which is compounded of the two colours.

9. From

9. From theſe phenomena, and from all the trials I have been able to make, it appears evidently, that in perfect human eyes, the centres of the two *retinæ* correſpond and harmonize with one another; and that every other point in one *retina*, doth correſpond and harmonize with the point which is ſimilarly ſituate in the other; in ſuch manner, that pictures falling on the correſponding points of the two *retinæ*, ſhew only one object, even when there are really two: and pictures falling upon points of the *retinæ* which do not correſpond, ſhew us two viſible appearances, although there be but one object. So that pictures, upon correſponding points of the two *retinæ*, preſent the ſame appearance to the mind as if they had both fallen upon the ſame point of one *retina*; and pictures upon points of the two *retinæ*, which do not correſpond, preſent to the mind the ſame apparent diſtance and poſition of two objects, as if one of thoſe pictures was carried to the point correſponding to it in the other *retina*. This relation and ſympathy between correſponding points of the two *retinæ*, I do not advance as an hypotheſis, but as a general fact or phenomenon of viſion. All the phenomena before mentioned, of ſingle or double viſion, lead to it,

it, and are neceſſary conſequences of it. It holds true invariably in all perfect human eyes, as far as I am able to collect from innumerable trials of various kinds made upon my own eyes, and many made by others at my deſire. Moſt of the hypotheſes that have been contrived to reſolve the phenomena of ſingle and double viſion, ſuppoſe this general fact, while their authors were not aware of it. Sir ISAAC NEWTON, who was too judicious a philoſopher, and too accurate an obſerver, to have offered even a conjecture which did not tally with the facts that had fallen under his obſervation, propoſes a query with reſpect to the cauſe of it, *Optics*, *quer.* 15. The judicious Dr Smith, in his *Optics*, *lib.* 1. § 137. hath confirmed the truth of this general phenomenon from his own experience, not only as to the apparent unity of objects whoſe pictures fall upon the correſponding points of the *retinæ*, but alſo as to the apparent diſtance of the two appearances of the ſame object when ſeen double.

This general phenomenon appears therefore to be founded upon a very full induction, which is all the evidence we can have for a fact of this nature. Before we make an end of this ſubject, it will be proper to inquire,

firſt, Whether thoſe animals whoſe eyes have an adverſe poſition in their heads, and look contrary ways, have ſuch correſponding points in their *retinæ?* Secondly, What is the poſition of the correſponding points in imperfect human eyes, I mean in thoſe that ſquint? And, in the laſt place, Whether this harmony of the correſponding points in the *retinæ*, be natural and original, or the effect of cuſtom? And if it is original, Whether it can be accounted for by any of the laws of nature already diſcovered? or whether it is itſelf to be looked upon as a law of nature, and a part of the human conſtitution?

SECT.

SECT. XIV.

Of the laws of viſion in brute animals.

IT is the intention of nature, in giving eyes to animals, that they may perceive the ſituation of viſible objects, or the direction in which they are placed: it is probable, therefore, that, in ordinary caſes, every animal, whether it has many eyes or few, whether of one ſtructure or of another, ſees objects ſingle, and in their true and proper direction. And ſince there is a prodigious variety in the ſtructure, the motions, and the number of eyes in different animals and inſects, it is probable that the laws by which viſion is regulated, are not the ſame in all, but various, adapted to the eyes which nature hath given them.

Mankind naturally turn their eyes always the ſame way, ſo that the axes of the two eyes meet in one point. They naturally attend to, or look at that object only which is placed in the point where the axes meet. And whe-

then the object be more or leſs diſtant, the configuration of the eye is adapted to the diſtance of the object, ſo as to form a diſtinct picture of it.

When we uſe our eyes in this natural way, the two pictures of the object we look at, are formed upon the centres of the two *retinæ*; and the two pictures of any contiguous object are formed upon the points of the *retinæ* which are ſimilarly ſituate with regard to the centres. Therefore, in order to our ſeeing objects ſingle, and in their proper direction, with two eyes, it is ſufficient that we be ſo conſtituted, that objects whoſe pictures are formed upon the centres of the two *retinæ*, or upon points ſimilarly ſituate with regard to theſe centres, ſhall be ſeen in the ſame viſible place. And this is the conſtitution which nature hath actually given to human eyes.

When we diſtort our eyes from their parallel direction, which is an unnatural motion, but may be learned by practice; or when we direct the axes of the two eyes to one point, and at the ſame time direct our attention to ſome viſible object much nearer or much more diſtant than that point, which is alſo unnatural, yet may be learned; in theſe caſes, and in theſe only, we ſee one object double, or two

two objects confounded in one. In these cases, the two pictures of the same object are formed upon points of the *retinæ* which are not similarly situate, and so the object is seen double; or the two pictures of different objects are formed upon points of the *retinæ* which are similarly situate, and so the two objects are seen confounded in one place.

Thus it appears, that the laws of vision in the human constitution are wisely adapted to the natural use of human eyes, but not to that use of them which is unnatural. We see objects truly when we use our eyes in the natural way; but have false appearances presented to us when we use them in a way that is unnatural. We may reasonably think, that the case is the same with other animals. But is it not unreasonable to think, that those animals which naturally turn one eye towards one object, and another eye towards another object, must thereby have such false appearances presented to them, as we have when we do so against nature?

Many animals have their eyes by nature placed adverse and immoveable, the axes of the two eyes being always directed to opposite points. Do objects painted on the centres of the two *retinæ* appear to such animals as they

do to human eyes, in one and the ſame viſible place? I think it is highly probable that they do not; and that they appear, as they really are, in oppoſite places.

If we judge from analogy in this caſe, it will lead us to think that there is a certain correſpondence between points of the two *retinæ* in ſuch animals, but of a different kind from that which we have found in human eyes. The centre of one *retina* will correſpond with the centre of the other, in ſuch manner, that the objects whoſe pictures are formed upon theſe correſponding points, ſhall appear not to be in the ſame place, as in human eyes, but in oppoſite places. And in the ſame manner will the ſuperior part of one *retina* correſpond with the inferior part of the other, and the anterior part of one with the poſterior part of the other.

Some animals, by nature, turn their eyes with equal facility, either the ſame way, or different ways, as we turn our hands and arms. Have ſuch animals correſponding points in their *retinæ*, and points which do not correſpond, as the human kind has? I think it is probable that they have not; becauſe ſuch a conſtitution in them could ſerve no other purpoſe but to exhibit falſe appearances.

If

If we judge from analogy, it will lead us to think, that as ſuch animals move their eyes in a manner ſimilar to that in which we move our arms, they have an immediate and natural perception of the direction they give to their eyes, as we have of the direction we give to our arms; and perceive the ſituation of viſible objects by their eyes, in a manner ſimilar to that in which we perceive the ſituation of tangible objects with our hands.

We cannot teach brute animals to uſe their eyes in any other way than in that which nature hath taught them; nor can we teach them to communicate to us the appearances which viſible objects make to them, either in ordinary or in extraordinary caſes. We have not therefore the ſame means of diſcovering the laws of viſion in them, as in our own kind, but muſt ſatisfy ourſelves with probable conjectures: and what we have ſaid upon this ſubject, is chiefly intended to ſhew, that animals to which nature hath given eyes differing in their number, in their poſition, and in their natural motions, may very probably be ſubjected to different laws of viſion, adapted to the peculiarities of their organs of viſion.

SECT. XV.

Squinting conſidered hypothetically.

WHETHER there be correſponding points in the *retinæ*, of thoſe who have an involuntary ſquint? and if there are, whether they be ſituate in the ſame manner as in thoſe who have no ſquint? are not queſtions of mere curioſity. They are of real importance to the phyſician who attempts the cure of a ſquint, and to the patient who ſubmits to the cure. After ſo much has been ſaid of the *ſtrabiſmus*, or ſquint, both by medical and by optical writers, one might expect to find abundance of facts for determining theſe queſtions. Yet I confeſs I have been diſappointed in this expectation, after taking ſome pains both to make obſervations, and to collect thoſe which have been made by others.

Nor will this appear very ſtrange, if we conſider, that, to make the obſervations which are neceſſary for determining theſe queſtions, knowledge of the principles of optics, and of the

the laws of viſion, muſt concur with opportunities rarely to be met with.

Of thoſe who ſquint, the far greater part have no diſtinct viſion with one eye. When this is the caſe, it is impoſſible, and indeed of no importance, to determine the ſituation of the correſponding points. When both eyes are good, they commonly differ ſo much in their direction, that the ſame object cannot be ſeen by both at the ſame time; and in this caſe it will be very difficult to determine the ſituation of the correſponding points; for ſuch perſons will probably attend only to the objects of one eye, and the objects of the other will be as little regarded as if they were not ſeen.

We have before obſerved, that when we look at a near object, and attend to it, we do not perceive the double appearances of more diſtant objects, even when they are in the ſame direction, and are preſented to the eye at the ſame time. It is probable that a ſquinting perſon, when he attends to the objects of one eye, will, in like manner, have his attention totally diverted from the objects of the other: and that he will perceive them as little as we perceive the double appearances of objects when we uſe our eyes in the natural way.

way. Such a perſon, therefore, unleſs he is ſo much a philoſopher as to have acquired the habit of attending very accurately to the viſible appearances of objects, and even of objects which he does not look at, will not be able to give any light to the queſtions now under conſideration.

It is very probable that hares, rabbits, birds, and fiſhes, whoſe eyes are fixed in an adverſe poſition, have the natural faculty of attending at the ſame time to viſible objects placed in different, and even in contrary directions; becauſe, without this faculty, they could not have thoſe advantages from the contrary direction of their eyes, which nature ſeems to have intended. But it is not probable that thoſe who ſquint have any ſuch natural faculty; becauſe we find no ſuch faculty in the reſt of the ſpecies. We naturally attend to objects placed in the point where the axes of the two eyes meet, and to them only. To give attention to an object in a different direction is unnatural, and not to be learned without pains and practice.

A very convincing proof of this may be drawn from a fact now well known to philoſophers: when one eye is ſhut, there is a certain ſpace within the field of viſion, where we can

can ſee nothing at all; the ſpace which is directly oppoſed to that part of the bottom of the eye where the optic nerve enters. This defect of ſight, in one part of the eye, is common to all human eyes, and hath been ſo from the beginning of the world; yet it was never known, until the ſagacity of the Abbé MARIOTTE diſcovered it in the laſt century. And now when it is known, it cannot be perceived, but by means of ſome particular experiments, which require care and attention to make them ſucceed.

What is the reaſon that ſo remarkable a defect of ſight, common to all mankind, was ſo long unknown, and is now perceived with ſo much difficulty? It is ſurely this, That the defect is at ſome diſtance from the axis of the eye, and conſequently in a part of the field of viſion to which we never attend naturally, and to which we cannot attend at all, without the aid of ſome particular circumſtances.

From what we have ſaid, it appears, that, to determine the ſituation of the correſponding points in the eyes of thoſe who ſquint, is impoſſible, if they do not ſee diſtinctly with both eyes; and that it will be very difficult, unleſs the two eyes differ ſo little in their direction, that the ſame object may be ſeen with both

both at the ſame time. Such patients I apprehend are rare; at leaſt there are very few of them with whom I have had the fortune to meet: and therefore, for the aſſiſtance of thoſe who may have happier opportunities, and inclination to make the proper uſe of them, we ſhall conſider the caſe of ſquinting hypothetically, pointing out the proper articles of inquiry, the obſervations that are wanted, and the concluſions that may be drawn from them.

1. It ought to be inquired, Whether the ſquinting perſon ſees equally well with both eyes? and, if there be a defect in one, the nature and degree of that defect ought to be remarked. The experiments by which this may be done, are ſo obvious, that I need not mention them. But I would adviſe the obſerver to make the proper experiments, and not to rely upon the teſtimony of the patient; becauſe I have found many inſtances, both of perſons that ſquinted, and others, who were found, upon trial, to have a great defect in the ſight of one eye, although they were never aware of it before. In all the following articles, it is ſuppoſed that the patient ſees with both eyes ſo well, as to be able to read with either, when the other is covered.

2. It

2. It ought to be inquired, Whether, when one eye is covered, the other is turned directly to the object? This ought to be tried in both eyes ſucceſſively. By this obſervation, as a touch-ſtone, we may try the hypotheſis concerning ſquinting, invented by M. de la HIRE, and adopted by BOERHAAVE, and many others of the medical faculty.

The hypotheſis is, That in one eye of a ſquinting perſon, the greateſt ſenſibility and the moſt diſtinct viſion is not, as in other men, in the centre of the *retina*, but upon one ſide of the centre; and that he turns the axis of this eye aſide from the object, in order that the picture of the object may fall upon the moſt ſenſible part of the *retina*, and thereby give the moſt diſtinct viſion. If this is the cauſe of ſquinting, the ſquinting eye will be turned aſide from the object, when the other eye is covered, as well as when it is not.

A trial ſo eaſy to be made, never was made for more than forty years; but the hypotheſis was very generally received. So prone are men to invent hypotheſes, and ſo backward to examine them by facts. At laſt Dr JURIN having made the trial, found that perſons who ſquint, turn the axis of the ſquinting eye directly

rectly to the object, when the other eye is covered. This fact is confirmed by Dr PORTERFIELD; and I have found it verified in all the inſtances that have fallen under my obſervation.

3. It ought to be inquired, Whether the axes of the two eyes follow one another, ſo as to have always the ſame inclination, or make the ſame angle, when the perſon looks to the right or to the left, upward or downward, or ſtraight forward. By this obſervation we may judge, whether a ſquint is owing to any defect in the muſcles which move the eye, as ſome have ſuppoſed. In the following articles we ſuppoſe that the inclination of the axes of the eyes is found to be always the ſame.

4. It ought to be inquired, Whether the perſon that ſquints ſees an object ſingle or double?

If he ſees the object double; and if the two appearances have an angular diſtance equal to the angle which the axes of his eyes make with each other, it may be concluded that he hath correſponding points in the *retinæ* of his eyes, and that they have the ſame ſituation as in thoſe who have no ſquint. If the two appearances ſhould have an angular diſtance,

diſtance, which is always the ſame, but manifeſtly greater or leſs than the angle contained under the optic axes, this would indicate correſponding points in the *retinæ*, whoſe ſituation is not the ſame as in thoſe who have no ſquint; but it is difficult to judge accurately of the angle which the optic axes make.

A ſquint, too ſmall to be perceived, may occaſion double viſion of objects: for if we ſpeak ſtrictly, every perſon ſquints more or leſs, whoſe optic axes do not meet exactly in the object which he looks at. Thus, if a man can only bring the axes of his eyes to be parallel, but cannot make them converge in the leaſt, he muſt have a ſmall ſquint in looking at near objects, and will ſee them double, while he ſees very diſtant objects ſingle. Again, if the optic axes always converge, ſo as to meet eight or ten feet before the face at fartheſt, ſuch a perſon will ſee near objects ſingle; but when he looks at very diſtant objects, he will ſquint a little, and ſee them double.

An inſtance of this kind is related by AGUILONIUS in his *Optics;* who ſays, that he had ſeen a young man to whom near objects appeared

appeared ſingle, but diſtant objects appeared double.

Dr BRIGGS, in his *Nova viſionis theoria*, having collected from authors ſeveral inſtances of double viſion, quotes this from AGUILONIUS, as the moſt wonderful and unaccountable of all, in ſo much that he ſuſpects ſome impoſition on the part of the young man: but to thoſe who underſtand the laws by which ſingle and double viſion are regulated, it appears to be the natural effect of a very ſmall ſquint.

Double viſion may always be owing to a ſmall ſquint, when the two appearances are ſeen at a ſmall angular diſtance, although no ſquint was obſerved: and I do not remember any inſtances of double viſion recorded by authors, wherein any account is given of the angular diſtance of the appearances.

In almoſt all the inſtances of double viſion, there is reaſon to ſuſpect a ſquint or diſtortion of the eyes, from the concomitant circumſtances, which we find to be one or other of the following, the approach of death, or of a *deliquium*, exceſſive drinking, or other intemperance, violent headach, bliſtering the head, ſmoking tobacco, blows or wounds in the head. In all theſe caſes, it is reaſonable

to

to ſuſpect a diſtortion of the eyes, either from ſpaſm, or paralyſis in the muſcles that move them. But although it be probable that there is always a ſquint greater or leſs where there is double viſion; yet it is certain that there is not double viſion always where there is a ſquint. I know no inſtance of double viſion that continued for life, or even for a great number of years. We ſhall therefore ſuppoſe, in the following articles, that the ſquinting perſon ſees objects ſingle.

5. The next inquiry then ought to be, Whether the object is ſeen with both eyes at the ſame time, or only with the eye whoſe axis is directed to it? It hath been taken for granted, by the writers upon the *ſtrabiſmus*, before Dr JURIN, that thoſe who ſquint, commonly ſee objects ſingle with both eyes at the ſame time; but I know not one fact advanced by any writer which proves it. Dr JURIN is of a contrary opinion; and as it is of conſequence, ſo it is very eaſy to determine this point in particular inſtances, by this obvious experiment. While the perſon that ſquints looks ſteadily at an object, let the obſerver carefully remark the direction of both his eyes, and obſerve their motions; and let an opaque body be interpoſed between the

object and the two eyes ſucceſſively. If the patient, notwithſtanding this interpoſition, and without changing the direction of the eyes, continues to ſee the object all the time, it may be concluded that he ſaw it with both eyes at once. But if the interpoſition of the body between one eye and the object makes it diſappear, then we may be certain, that it was ſeen by that eye only. In the two following articles, we ſhall ſuppoſe the firſt to happen, according to the common hypotheſis.

6. Upon this ſuppoſition, it ought to be inquired, Whether the patient ſees an object double in thoſe circumſtances wherein it appears double to them who have no ſquint? Let him, for inſtance, place a candle at the diſtance of ten feet; and holding his finger at arm's length between him and the candle, let him obſerve, when he looks at the candle, whether he ſees his finger with both eyes, and whether he ſees it ſingle or double; and when he looks at his finger, let him obſerve whether he ſees the candle with both eyes, and whether ſingle or double.

By this obſervation, it may be determined, whether to this patient, the phenomena of double as well as of ſingle viſion are the ſame

as

as to them who have no ſquint. If they are not the ſame; if he ſees objects ſingle with two eyes, not only in the caſes wherein they appear ſingle, but in thoſe alſo wherein they appear double to other men; the concluſion to be drawn from this ſuppoſition is, that his ſingle viſion does not ariſe from correſponding points in the *retinæ* of his eyes; and that the laws of viſion are not the ſame in him as in the reſt of mankind.

7. If, on the other hand, he ſees objects double in thoſe caſes wherein they appear double to others, the concluſion muſt be, that he hath correſponding points in the *retinæ* of his eyes, but unnaturally ſituate; and their ſituation may be thus determined.

When he looks at an object, having the axis of one eye directed to it, and the axis of the other turned aſide from it; let us ſuppoſe a right line to paſs from the object through the centre of the diverging eye. We ſhall, for the ſake of perſpicuity, call this right line *the natural axis of the eye:* and it will make an angle with the real axis, greater or leſs, according as his ſquint is greater or leſs. We ſhall alſo call that point of the *retina* in which the natural axis cuts it, *the natural centre of the retina;* which will be more or leſs diſtant

from the real centre, according as the ſquint is greater or leſs.

Having premiſed theſe definitions, it will be evident to thoſe who underſtand the principles of optics, that in this perſon the natural centre of one *retina* correſponds with the real centre of the other, in the very ſame manner as the two real centres correſpond in perfect eyes; and that the points ſimilarly ſituate with regard to the real centre in one *retina*, and the natural centre in the other, do likewiſe correſpond, in the very ſame manner as the points ſimilarly ſituate with regard to the two real centres correſpond in perfect eyes.

If it is true, as has been commonly affirmed, that one who ſquints ſees an object with both eyes at the ſame time, and yet ſees it ſingle, the ſquint will moſt probably be ſuch as we have deſcribed in this article. And we may further conclude, that if a perſon affected with ſuch a ſquint as we have ſuppoſed, could be brought to the habit of looking ſtraight, his ſight would thereby be greatly hurt. For he would then ſee every thing double which he ſaw with both eyes at the ſame time; and objects diſtant from one another, would appear to be confounded together.

ther. His eyes are made for ſquinting, as much as thoſe of other men are made for looking ſtraight; and his ſight would be no leſs injured by looking ſtraight, than that of another man by ſquinting. He can never ſee perfectly when he does not ſquint, unleſs the correſponding points of his eyes ſhould by cuſtom change their place; but how ſmall the probability of this is, will appear in the 17th ſection.

Thoſe of the medical faculty who attempt the cure of a ſquint, would do well to conſider whether it is attended with ſuch ſymptoms as are above deſcribed. If it is, the cure would be worſe than the malady: for every one will readily acknowledge, that it is better to put up with the deformity of a ſquint, than to purchaſe the cure by the loſs of perfect and diſtinct viſion.

8. We ſhall now return to Dr JURIN's hypotheſis, and ſuppoſe, that our patient, when he ſaw objects ſingle notwithſtanding his ſquint, was found, upon trial, to have ſeen them only with one eye.

We would adviſe ſuch a patient, to endeavour, by repeated efforts, to leſſen his ſquint, and to bring the axes of his eyes nearer to a parallel direction. We have naturally the

power of making ſmall variations in the inclination of the optic axes; and this power may be greatly increaſed by exerciſe.

In the ordinary and natural uſe of our eyes, we can direct their axes to a fixed ſtar; in this caſe they muſt be parallel: we can direct them alſo to an object ſix inches diſtant from the eye; and in this caſe the axes muſt make an angle of fifteen or twenty degrees. We ſee young people in their frolics learn to ſquint, making their eyes either converge or diverge, when they will, to a very conſiderable degree. Why ſhould it be more difficult for a ſquinting perſon to learn to look ſtraight when he pleaſes? If once, by an effort of his will, he can but leſſen his ſquint, frequent practice will make it eaſy to leſſen it, and will daily increaſe his power. So that if he begins this practice in youth, and perſeveres in it, he may probably, after ſome time, learn to direct both his eyes to one object.

When he hath acquired this power, it will be no difficult matter to determine, by proper obſervations, whether the centres of the *retinæ*, and other points ſimilarly ſituate with regard to the centres, correſpond, as in other men.

9. Let

9. Let us now ſuppoſe that he finds this to be the caſe; and that he ſees an object ſingle with both eyes, when the axes of both are directed to it. It will then concern him to acquire the habit of looking ſtraight, as he hath got the power, becauſe he will thereby not only remove a deformity, but improve his ſight: and I conceive this habit, like all others, may be got by frequent exerciſe. He may practiſe before a mirror when alone, and in company he ought to have thoſe about him, who will obſerve and admoniſh him when he ſquints.

10. What is ſuppoſed in the 9th article, is not merely imaginary; it is really the caſe of ſome ſquinting perſons, as will appear in the next ſection. Therefore it ought further to be inquired, How it comes to paſs, that ſuch a perſon ſees an object which he looks at, only with one eye, when both are open? In order to anſwer this queſtion, it may be obſerved, firſt, Whether, when he looks at an object, the diverging eye is not drawn ſo cloſe to the noſe, that it can have no diſtinct images? Or, ſecondly, Whether the pupil of the diverging eye is not covered wholly, or in part, by the upper eyelid? Dr JURIN obſerved inſtances of theſe caſes in perſons that

ſquinted, and aſſigns them as cauſes of their ſeeing the object only with one eye. Thirdly, it may be obſerved, Whether the diverging eye is not ſo directed, that the picture of the object falls upon that part of the *retina* where the optic nerve enters, and where there is no viſion? This will probably happen in a ſquint wherein the axes of the eyes converge, ſo as to meet about ſix inches before the noſe.

11. In the laſt place, it ought to be inquired, Whether ſuch a perſon hath any diſtinct viſion at all with the diverging eye, at the time he is looking at an object with the other?

It may ſeem very improbable, that he ſhould be able to read with the diverging eye when the other is covered, and yet, when both are open, have no diſtinct viſion with it at all. But this perhaps will not appear ſo improbable, if the following conſiderations are duly attended to.

Let us ſuppoſe that one who ſaw perfectly, gets, by a blow on the head, or ſome other accident, a permanent and involuntary ſquint. According to the laws of viſion, he will ſee objects double, and will ſee objects diſtant from one another confounded together: but ſuch

ſuch viſion being very diſagreeable, as well as inconvenient, he will do every thing in his power to remedy it. For alleviating ſuch diſtreſſes, nature often teaches men wonderful experiments, which the ſagacity of a philoſopher would be unable to diſcover. Every accidental motion, every direction or conformation of his eyes, which leſſens the evil, will be agreeable; it will be repeated, until it be learned to perfection, and become habitual, even without thought or deſign. Now, in this caſe, what diſturbs the ſight of one eye, is the ſight of the other; and all the diſagreeable appearances in viſion would ceaſe, if the light of one eye was extinct: The ſight of one eye will become more diſtinct and more agreeable, in the ſame proportion as that of the other becomes faint and indiſtinct. It may therefore be expected, that every habit will, by degrees, be acquired, which tends to deſtroy diſtinct viſion in one eye, while it is preſerved in the other. Theſe habits will be greatly facilitated, if one eye was at firſt better than the other; for in that caſe the beſt eye will always be directed to the object which he intends to look at, and every habit will be acquired which tends to hinder

hinder his ſeeing it at all, or ſeeing it diſtinctly by the other at the ſame time.

I ſhall mention one or two habits that may probably be acquired in ſuch a caſe; perhaps there are others which we cannot ſo eaſily conjecture. Firſt, By a ſmall increaſe or diminution of his ſquint, he may bring it to correſpond with one or other of the caſes mentioned in the laſt article. Secondly, The diverging eye may be brought to ſuch a conformation as to be extremely ſhort-ſighted, and conſequently to have no diſtinct viſion of objects at a diſtance. I knew this to be the caſe of one perſon that ſquinted; but cannot ſay whether the ſhort-ſightedneſs of the diverging eye was original, or acquired by habit.

We ſee, therefore, that one who ſquints, and originally ſaw objects double by reaſon of that ſquint, may acquire ſuch habits, that when he looks at an object, he ſhall ſee it only with one eye: nay, he may acquire ſuch habits, that when he looks at an object with his beſt eye, he ſhall have no diſtinct viſion with the other at all. Whether this is really the caſe, being unable to determine in the inſtances that have fallen under my obſervation, I ſhall leave to future inquiry.

I have endeavoured, in the foregoing articles, to delineate ſuch a proceſs as is proper in obſerving the phenomena of ſquinting. I know well by experience, that this proceſs appears more eaſy in theory, than it will be found to be in practice; and that in order to carry it on with ſucceſs, ſome qualifications of mind are neceſſary in the patient, which are not always to be met with. But if thoſe who have proper opportunities, and inclination, to obſerve ſuch phenomena, attend duly to this proceſs, they may be able to furniſh facts leſs vague and uninſtructive than thoſe we meet with, even in authors of reputation. By ſuch facts, vain theories may be exploded, and our knowledge of the laws of nature, which regard the nobleſt of our ſenſes, enlarged.

SECT.

SECT. XVI.

Facts relating to ſquinting.

HAVING conſidered the phenomena of ſquinting hypothetically, and their connection with correſponding points in the *retinæ*, I ſhall now mention the facts I have had occaſion to obſerve myſelf, or have met with in authors, that can give any light to this ſubject.

Having examined above twenty perſons that ſquinted, I found in all of them a defect in the ſight of one eye. Four only had ſo much of diſtinct viſion in the weak eye, as to be able to read with it when the other was covered. The reſt ſaw nothing at all diſtinctly with one eye.

Dr PORTERFIELD ſays, that this is generally the caſe of people that ſquint: and I ſuſpect it is ſo more generally than is commonly imagined. Dr JURIN, in a very judicious diſſertation upon ſquinting, printed in Dr SMITH'S

SMITH's Optics, obſerves, that thoſe who ſquint, and ſee objects with both eyes, never ſee the ſame object with both at the ſame time; that when one eye is directed ſtraight forward to an object, the other is drawn ſo cloſe to the noſe, that the object cannot at all be ſeen by it, the images being too oblique and too indiſtinct to affect the eye. In ſome ſquinting perſons, he obſerved the diverging eye drawn under the upper eyelid, while the other was directed to the object. From theſe obſervations he concludes, that "the eye is thus diſtorted, not for the ſake of ſeeing better "with it, but rather to avoid ſeeing at all "with it as much as poſſible." From all the obſervations he had made, he was ſatisfied, that there is nothing peculiar in the ſtructure of a ſquinting eye; that the fault is only in its wrong direction; and that this wrong direction is got by habit. Therefore he propoſes that method of cure which we have deſcribed in the 8th and 9th articles of the laſt ſection. He tells us, that he had attempted a cure after this method, upon a young Gentleman, with promiſing hopes of ſucceſs; but was interrupted by his falling ill of the ſmall-pox, of which he died.

It

It were to be wiſhed that Dr JURIN had acquainted us, whether he ever brought the young man to direct the axes of both eyes to the ſame object, and whether, in that caſe, he ſaw the object ſingle, and ſaw it with both eyes; and that he had likewiſe acquainted us, whether he ſaw objects double when his ſquint was diminiſhed. But as to theſe facts he is ſilent.

I wiſhed long for an opportunity of trying Dr JURIN's method of curing a ſquint, without finding one; having always, upon examination, diſcovered ſo great a defect in the ſight of one eye of the patient as diſcouraged the attempt.

But I have lately found three young Gentlemen, with whom I am hopeful this method may have ſucceſs, if they have patience and perſeverance in uſing it. Two of them are brothers, and, before I had acceſs to examine them, had been practiſing this method by the direction of their tutor, with ſuch ſucceſs, that the elder looks ſtraight when he is upon his guard: the younger can direct both his eyes to one object; but they ſoon return to their uſual ſquint.

A third young Gentleman, who had never heard of this method before, by a few days practice,

practice, was able to direct both his eyes to one object, but could not keep them long in that direction. All the three agree in this, that when both eyes are directed to one object, they see it and the adjacent objects single; but when they squint, they see objects sometimes single and sometimes double. I observed of all the three, that when they squinted most, that is, in the way they had been accustomed to, the axes of their eyes converged, so as to meet five or six inches before the nose. It is probable that in this case the picture of the object in the diverging eye, must fall upon that part of the *retina* where the optic nerve enters; and therefore the object could not be seen by that eye.

All the three have some defect in the sight of one eye, which none of them knew until I put them upon making trials; and when they squint, the best eye is always directed to the object, and the weak eye is that which diverges from it. But when the best eye is covered, the weak eye is turned directly to the object. Whether this defect of sight in one eye, be the effect of its having been long disused, as it must have been when they squinted; or whether some original defect in one eye might be the occasion of their squinting,

time

time may diſcover. The two brothers have found the ſight of the weak eye improved by uſing to read with it while the other is covered. The elder can read an ordinary print with the weak eye; the other, as well as the third Gentleman, can only read a large print with the weak eye. I have met with one other perſon only who ſquinted, and yet could read a large print with the weak eye. He is a young man, whoſe eyes are both tender and weak-ſighted, but the left much weaker than the right. When he looks at any object, he always directs the right eye to it, and then the left is turned towards the noſe ſo much, that it is impoſſible for him to ſee the ſame object with both eyes at the ſame time. When the right eye is covered, he turns the left directly to the object; but he ſees it indiſtinctly, and as if it had a miſt about it.

I made ſeveral experiments, ſome of them in the company and with the aſſiſtance of an ingenious phyſician, in order to diſcover, whether objects that were in the axes of the two eyes, were ſeen in one place confounded together, as in thoſe who have no involuntary ſquint. The object placed in the axis of the weak eye was a lighted candle, at the diſtance of eight or ten feet. Before the other eye was

was placed a printed book, at ſuch a diſtance as that he could read upon it. He ſaid, that while he read upon the book, he ſaw the candle but very faintly. And from what we could learn, theſe two objects did not appear in one place, but had all that angular diſtance in appearance which they had in reality.

If this was really the caſe, the concluſion to be drawn from it is, that the correſponding points in his eyes are not ſituate in the ſame manner as in other men; and that if he could be brought to direct both eyes to one object, he would ſee it double. But conſidering that the young man had never been accuſtomed to obſervations of this kind, and that the ſight of one eye was ſo imperfect, I do not pretend to draw this concluſion with certainty from this ſingle inſtance.

All that can be inferred from theſe facts is, that of four perſons who ſquint, three appear to have nothing preternatural in the ſtructure of their eyes. The centres of the *retinæ*, and the points ſimilarly ſituate with regard to the centres, do certainly correſpond in the ſame manner as in other men. So that if they can be brought to the habit of directing their eyes right to an object, they will not only remove a deformity, but improve their ſight.

With regard to the fourth, the caſe is dubious, with ſome probability of a deviation from the uſual courſe of nature in the ſituation of the correſponding points of his eyes.

SECT. XVII.

Of the effect of cuſtom in ſeeing objects ſingle.

IT appears from the phenomena of ſingle and double viſion, recited in Sect. 13. that our ſeeing an object ſingle with two eyes, depends upon theſe two things. Firſt, Upon that mutual correſpondence of certain points of the *retinæ* which we have often deſcribed. Secondly, Upon the two eyes being directed to the object ſo accurately, that the two images of it fall upon correſponding points. Theſe two things muſt concur in order to our ſeeing an object ſingle with two eyes; and as far as they depend upon cuſtom, ſo far only can ſingle viſion depend upon cuſtom.

With regard to the ſecond, that is, the accurate direction of both eyes to the object, I think

think it muſt be acknowledged that this is only learned by cuſtom. Nature hath wiſely ordained the eyes to move in ſuch a manner, that their axes ſhall always be nearly parallel; but hath left it in our power to vary their inclination a little, according to the diſtance of the object we look at. Without this power, objects would appear ſingle at one particular diſtance only; and, at diſtances much leſs, or much greater, would always appear double. The wiſdom of nature is conſpicuous in giving us this power, and no leſs conſpicuous in making the extent of it exactly adequate to the end.

The paralleliſm of the eyes, in general, is therefore the work of nature; but that preciſe and accurate direction, which muſt be varied according to the diſtance of the object, is the effect of cuſtom. The power which nature hath left us of varying the inclination of the optic axes a little, is turned into a habit of giving them always that inclination which is adapted to the diſtance of the object.

But it may be aſked, What gives riſe to this habit? The only anſwer that can be given to this queſtion is, that it is found neceſſary to perfect and diſtinct viſion. A man who hath loſt the ſight of one eye, very often loſes

the habit of directing it exactly to the object he looks at, becauſe that habit is no longer of uſe to him. And if he ſhould recover the ſight of his eye, he would recover this habit, by finding it uſeful. No part of the human conſtitution is more admirable than that whereby we acquire habits which are found uſeful, without any deſign or intention. Children muſt ſee imperfectly at firſt; but, by uſing their eyes, they learn to uſe them in the beſt manner, and acquire, without intending it, the habits neceſſary for that purpoſe. Every man becomes moſt expert in that kind of viſion which is moſt uſeful to him in his particular profeſſion and manner of life. A miniature painter, or an engraver, ſees very near objects better than a ſailor; but the ſailor ſees very diſtant objects much better than they. A perſon that is ſhort-ſighted, in looking at diſtant objects, gets the habit of contracting the aperture of his eyes, by almoſt cloſing his eyelids. Why? For no other reaſon, but becauſe this makes him ſee the object more diſtinct. In like manner, the reaſon why every man acquires the habit of directing both eyes accurately to the object, muſt be, becauſe thereby he ſees it more perfectly and diſtinctly.

It

It remains to be conſidered, whether that correſpondence between certain points of the *retinæ*, which is likewiſe neceſſary to ſingle viſion, be the effect of cuſtom, or an original property of human eyes.

A ſtrong argument for its being an original property, may be drawn from the habit juſt now mentioned, of directing the eyes accurately to an object. This habit is got by our finding it neceſſary to perfect and diſtinct viſion. But why is it neceſſary? For no other reaſon but this, becauſe thereby the two images of the object falling upon correſponding points, the eyes aſſiſt each other in viſion, and the object is ſeen better by both together, than it could be by one; but when the eyes are not accurately directed, the two images of an object fall upon points that do not correſpond, whereby the ſight of one eye diſturbs the ſight of the other, and the object is ſeen more indiſtinctly with both eyes than it would be with one. Whence it is reaſonable to conclude, that this correſpondence of certain points of the *retinæ*, is prior to the habits we acquire in viſion, and conſequently is natural and original. We have all acquired the habit of directing our eyes always in a particular manner, which cauſes ſingle viſion. Now,

if nature hath ordained that we ſhould have ſingle viſion only, when our eyes are thus directed, there is an obvious reaſon why all mankind ſhould agree in the habit of directing them in this manner. But if ſingle viſion is the effect of cuſtom, any other habit of directing the eyes would have anſwered the purpoſe; and no account can be given why this particular habit ſhould be ſo univerſal; and it muſt appear very ſtrange, that no one inſtance hath been found of a perſon who had acquired the habit of ſeeing objects ſingle with both eyes, while they were directed in any other manner.

The judicious Dr SMITH, in his excellent Syſtem of Optics, maintains the contrary opinion, and offers ſome reaſonings and facts in proof of it. He agrees with Biſhop BERKELEY in attributing it entirely to cuſtom, that we ſee objects ſingle with two eyes, as well as that we ſee objects erect by inverted images. Having conſidered Biſhop BERKELEY's reaſonings in the 11th ſection, we ſhall now beg leave to make ſome remarks on what Dr SMITH hath ſaid upon this ſubject, with the reſpect due to an author to whom the world owes, not only many valuable diſcoveries of his own, but thoſe of the brighteſt mathema-

tical

tical genius of this age, which, with great labour, he generouſly redeemed from oblivion.

He obſerves, that the queſtion, Why we ſee objects ſingle with two eyes? is of the ſame ſort with this, Why we hear ſounds ſingle with two ears? and that the ſame anſwer muſt ſerve both. The inference intended to be drawn from this obſervation is, that as the ſecond of theſe phenomena is the effect of cuſtom, ſo likewiſe is the firſt.

Now I humbly conceive that the queſtions are not ſo much of the ſame ſort, that the ſame anſwer muſt ſerve for both; and moreover, that our hearing ſingle with two ears, is not the effect of cuſtom.

Two or more viſible objects, although perfectly ſimilar, and ſeen at the very ſame time, may be diſtinguiſhed by their viſible places; but two ſounds perfectly ſimilar, and heard at the ſame time, cannot be diſtinguiſhed; for, from the nature of ſound, the ſenſations they occaſion muſt coaleſce into one, and loſe all diſtinction. If therefore it is aſked, Why we hear ſounds ſingle with two ears? I anſwer, Not from cuſtom; but becauſe two ſounds which are perfectly like and ſynchronous, have nothing by which they can be di-

ſtinguiſhed. But will this anſwer fit the other queſtion? I think not.

The object makes an appearance to each eye, as the ſound makes an impreſſion upon each ear; ſo far the two ſenſes agree. But the viſible appearances may be diſtinguiſhed by place, when perfectly like in other reſpects; the ſounds cannot be thus diſtinguiſhed; and herein the two ſenſes differ. Indeed, if the two appearances have the ſame viſible place, they are, in that caſe, as incapable of diſtinction as the ſounds were, and we ſee the object ſingle. But when they have not the ſame viſible place, they are perfectly diſtinguiſhable, and we ſee the object double. We ſee the object ſingle only, when the eyes are directed in one particular manner; while there are many other ways of directing them within the ſphere of our power, by which we ſee the object double.

Dr SMITH juſtly attributes to cuſtom that well-known fallacy in feeling, whereby a button preſſed with two oppoſite ſides of two contiguous fingers laid acroſs is felt double. I agree with him, that the cauſe of this appearance is, that thoſe oppoſite ſides of the fingers have never been uſed to feel the ſame object, but two different objects, at the ſame time,

time. And I beg leave to add, that as cuſtom produces this phenomenon, ſo a contrary cuſtom deſtroys it: for if a man frequently accuſtoms himſelf to feel the button with his fingers acroſs, it will at laſt be felt ſingle; as I have found by experience.

It may be taken for a general rule, That things which are produced by cuſtom, may be undone or changed by diſuſe, or by a contrary cuſtom. On the other hand, it is a ſtrong argument, that an effect is not owing to cuſtom, but to the conſtitution of nature, when a contrary cuſtom, long continued, is found neither to change nor weaken it. I take this to be the beſt rule by which we can determine the queſtion preſently under conſideration. I ſhall therefore mention two facts brought by Dr SMITH, to prove that the correſponding points of the *retinæ* have been changed by cuſtom; and then I ſhall mention ſome facts tending to prove, that there are correſponding points of the *retinæ* of the eyes originally, and that cuſtom produces no change in them.

" One fact is related upon the authority of " MARTIN FOLKES, Eſq; who was informed by " Dr HEPBURN of Lynn, that the Reverend " Mr FOSTER of Clinchwharton, in that neigh-

" bourhood,

" bourhood, having been blind for ſome years " of a *gutta ſerena*, was reſtored to ſight by " ſalivation: and that, upon his firſt begin- " ning to ſee, all objects appeared to him " double; but afterwards the two appear- " ances approaching by degrees, he came at " laſt to ſee ſingle, and as diſtinctly as he did " before he was blind."

Upon this caſe I obſerve, firſt, That it does not prove any change of the correſponding points of the eyes, unleſs we ſuppoſe, what is not affirmed, that Mr FOSTER directed his eyes to the object at firſt, when he ſaw double, with the ſame accuracy, and in the ſame manner, that he did afterwards when he ſaw ſingle. 2dly, If we ſhould ſuppoſe this, no account can be given, why at firſt the two appearances ſhould be ſeen at one certain angular diſtance rather than another; or why this angular diſtance ſhould gradually decreaſe, until at laſt the appearances coincided. How could this effect be produced by cuſtom? But, thirdly, Every circumſtance of this caſe may be accounted for, on the ſuppoſition that Mr FOSTER had correſponding points in the *retinæ* of his eyes from the time he began to ſee, and that cuſtom made no change with regard to them. We need only further ſuppoſe,

poſe, what is common in ſuch caſes, that by ſome years blindneſs he had loſt the habit of directing his eyes accurately to an object, and that he gradually recovered this habit when he came to ſee.

The ſecond fact mentioned by Dr SMITH, is taken from Mr CHESELDEN's Anatomy; and is this: "A gentleman who, from a blow on "the head, had one eye diſtorted, found eve- "ry object appear double; but by degrees "the moſt familiar ones became ſingle; and "in time all objects became ſo, without any "amendment of the diſtortion."

I obſerve here, that it is not ſaid that the two appearances gradually approached, and at laſt united, without any amendment of the diſtortion. This would indeed have been a deciſive proof of a change in the correſponding points of the *retinæ*; and yet of ſuch a change as could not be accounted for from cuſtom. But this is not ſaid; and if it had been obſerved, a circumſtance ſo remarkable would have been mentioned by Mr CHESELDEN, as it was in the other caſe by Dr HEPBURN. We may therefore take it for granted, that one of the appearances vaniſhed by degrees, without approaching to the other. And this I conceive might happen ſeveral ways.

ways. Firſt, The ſight of the diſtorted eye might gradually decay by the hurt; ſo the appearances preſented by that eye would gradually vaniſh. Secondly, A ſmall and unperceived change in the manner of directing the eyes, might occaſion his not ſeeing the object with the diſtorted eye, as appears from Sect. 15. Art. 10. Thirdly, By acquiring the habit of directing one and the ſame eye always to the object, the faint and oblique appearance, preſented by the other eye, might be ſo little attended to when it became familiar, as not to be perceived. One of theſe cauſes, or more of them concurring, might produce the effect mentioned, without any change of the correſponding points of the eyes.

For theſe reaſons, the facts mentioned by Dr SMITH, although curious, ſeem not to be deciſive.

The following facts ought to be put in the oppoſite ſcale. Firſt, In the famous caſe of the young gentleman couched by Mr CHESELDEN, after having had cataracts on both eyes until he was thirteen years of age, it appears, that he ſaw objects ſingle from the time he began to ſee with both eyes. Mr CHESELDEN's words are: "And now being lately "couched of his other eye, he ſays, that ob-

"jects,

" jects, at firſt appeared large to this eye, but " not ſo large as they did at firſt to the other; " and looking upon the ſame object with " both eyes, he thought it looked about twice " as large as with the firſt couched eye only, " but not double, that we can anywiſe diſ- " cover."

Secondly, The three young gentlemen mentioned in the laſt ſection, who had ſquinted, as far as I know, from infancy; as ſoon as they learned to direct both eyes to an object, ſaw it ſingle. In theſe four caſes, it appears evident, that the centres of the *retinæ* correſponded originally, and before cuſtom could produce any ſuch effect: for Mr CHESELDEN's young gentleman had never been accuſtomed to ſee at all before he was couched; and the other three had never been accuſtomed to direct the axes of both eyes to the object.

Thirdly, From the facts recited in Sect. 13. it appears, That from the time we are capable of obſerving the phenomena of ſingle and double viſion, cuſtom makes no change in them.

I have amuſed myſelf with ſuch obſervations for more than thirty years; and in every caſe wherein I ſaw the object double at firſt,

I ſee it ſo to this day, notwithſtanding the conſtant experience of its being ſingle. In other caſes where I know there are two objects, there appears only one, after thouſands of experiments.

Let a man look at a familiar object through a polyhedron or multiplying-glaſs every hour of his life, the number of viſible appearances will be the ſame at laſt as at firſt: nor does any number of experiments, or length of time, make the leaſt change.

Effects produced by habit, muſt vary according as the acts by which the habit is acquired are more or leſs frequent: but the phenomena of ſingle and double viſion are ſo invariable and uniform in all men, are ſo exactly regulated by mathematical rules, that I think we have good reaſon to conclude, that they are not the effect of cuſtom, but of fixed and immutable laws of nature.

SECT.

SECT. XVIII.

Of Dr PORTERFIELD'S *account of ſingle and double viſion.*

BISHOP BERKELEY and Dr SMITH ſeem to attribute too much to cuſtom in viſion; Dr PORTERFIELD too little.

This ingenious writer thinks, that, by an original law of our nature, antecedent to cuſtom and experience, we perceive viſible objects in their true place, not only as to their direction, but likewiſe as to their diſtance from the eye: and therefore he accounts for our ſeeing objects ſingle, with two eyes, in this manner. Having the faculty of perceiving the object with each eye in its true place, we muſt perceive it with both eyes in the ſame place; and conſequently muſt perceive it ſingle.

He is aware, that this principle, although it accounts for our ſeeing objects ſingle with two eyes, yet does not at all account for our ſeeing

ſeeing objects double: and whereas other writers on this ſubject take it to be a ſufficient cauſe for double viſion that we have two eyes, and only find it difficult to aſſign a cauſe for ſingle viſion; on the contrary, Dr PORTERFIELD's principle throws all the difficulty on the other ſide.

Therefore, in order to account for the phenomena of double viſion, he advances another principle, without ſignifying whether he conceives it to be an original law of our nature, or the effect of cuſtom. It is, That our natural perception of the diſtance of objects from the eye, is not extended to all the objects that fall within the field of viſion, but limited to that which we directly look at; and that the circumjacent objects, whatever be their real diſtance, are ſeen at the ſame diſtance with the object we look at; as if they were all in the ſurface of a ſphere whereof the eye is the centre.

Thus, ſingle viſion is accounted for by our ſeeing the true diſtance of an object which we look at; and double viſion, by a falſe appearance of diſtance in objects which we do not directly look at.

We agree with this learned and ingenious author, that it is by a natural and original principle

principle that we ſee viſible objects in a certain direction from the eye, and honour him as the author of this diſcovery: but we cannot aſſent to either of thoſe principles by which he explains ſingle and double viſion, for the following reaſons:

1. Our having a natural and original perception of the diſtance of objects from the eye, appears contrary to a well-atteſted fact: for the young gentleman couched by Mr CHESELDEN, imagined at firſt, that whatever he ſaw, touched his eye, as what he felt touched his hand.

2. The perception we have of the diſtance of objects from the eye, whether it be from nature or cuſtom, is not ſo accurate and determinate as is neceſſary to produce ſingle viſion. A miſtake of the twentieth or thirtieth part of the diſtance of a ſmall object, ſuch as a pin, ought, according to Dr PORTERFIELD's hypotheſis, to make it appear double. Very few can judge of the diſtance of a viſible object with ſuch accuracy. Yet we never find double viſion produced by miſtaking the diſtance of the object. There are many caſes in viſion, even with the naked eye, wherein we miſtake the diſtance of an object by one half or more: why do we ſee ſuch objects

ſingle? When I move my ſpectacles from my eyes toward a ſmall object, two or three feet diſtant, the object ſeems to approach, ſo as to be ſeen at laſt at about half its real diſtance; but it is ſeen ſingle at that apparent diſtance, as well as when we ſee it with the naked eye at its real diſtance. And when we look at an object with a binocular teleſcope, properly fitted to the eyes, we ſee it ſingle, while it appears fifteen or twenty times nearer than it is. There are then few caſes wherein the diſtance of an object from the eye is ſeen ſo accurately as is neceſſary for ſingle viſion, upon this hypotheſis: This ſeems to be a concluſive argument againſt the account given of ſingle viſion. We find, likewiſe, that falſe judgments or fallacious appearances of the diſtance of an object, do not produce double viſion. This ſeems to be a concluſive argument againſt the account given of double viſion.

3. The perception we have of the linear diſtance of objects, ſeems to be wholly the effect of experience. This I think hath been proved by Biſhop BERKELEY and by Dr SMITH; and when we come to point out the means of judging of diſtance by ſight, it will appear that they are all furniſhed by experience.

4. Suppoſing

4. Suppoſing that by a law of our nature, the diſtance of objects from the eye were perceived moſt accurately, as well as their direction, it will not follow that we muſt ſee the object ſingle. Let us conſider what means ſuch a law of nature would furniſh for reſolving the queſtion, Whether the objects of the two eyes are in one and the ſame place, and conſequently are not two, but one?

Suppoſe then two right lines, one drawn from the centre of one eye to its object, the other drawn, in like manner, from the centre of the other eye to its object. This law of nature gives us the direction or poſition of each of theſe right lines, and the length of each; and this is all that it gives. Theſe are geometrical *data*, and we may learn from geometry what is determined by their means. Is it then determined by theſe *data*, Whether the two right lines terminate in one and the ſame point, or not? No truly. In order to determine this, we muſt have three other *data*. We muſt know whether the two right lines are in one plane: we muſt know what angle they make, and we muſt know the diſtance between the centres of the eyes. And, when theſe things are known, we muſt apply the rules of trigonometry, before we can reſolve

the queſtion, Whether the objects of the two eyes are in one and the ſame place; and conſequently whether they are two or one?

5. That falſe appearance of diſtance into which double viſion is reſolved, cannot be the effect of cuſtom; for conſtant experience contradicts it: Neither hath it the features of a law of nature; becauſe it does not anſwer any good purpoſe, nor indeed any purpoſe at all but to deceive us. But why ſhould we ſeek for arguments, in a queſtion concerning what appears to us, or does not appear? The queſtion is, At what diſtance do the objects now in my eye appear? Do they all appear at one diſtance, as if placed in the concave ſurface of a ſphere, the eye being in the centre? Every man ſurely may know this with certainty; and, if he will but give attention to the teſtimony of his eyes, needs not aſk a philoſopher, how viſible objects appear to him. Now, it is very true, that if I look up to a ſtar in the heavens, the other ſtars that appear at the ſame time, do appear in this manner: Yet this phenomenon does not favour Dr PORTERFIELD's hypotheſis; for the ſtars and heavenly bodies, do not appear at their true diſtances when we look directly to them, any more than when they are ſeen obliquely:

liquely: and if this phenomenon be an argument for Dr PORTERFIELD's ſecond principle, it muſt deſtroy the firſt.

The true cauſe of this phenomenon will be given afterwards; therefore, ſetting it aſide for the preſent, let us put another caſe. I ſit in my room, and direct my eyes to the door, which appears to be about ſixteen feet diſtant: at the ſame time I ſee many other objects faintly and obliquely; the floor, floor-cloth, the table which I write upon, papers, ſtandiſh, candle, &c. Now, do all theſe objects appear at the ſame diſtance of ſixteen feet? Upon the cloſeſt attention, I find they do not.

SECT. XIX.

Of Dr BRIGGS's *theory, and Sir* ISAAC NEWTON's *conjecture on this ſubject.*

I AM afraid the reader, as well as the writer, is already tired of the ſubject of ſingle and double viſion. The multitude of theories advanced by authors of great name, and the multitude of facts, obſerved without ſufficient ſkill in optics, or related without attention to the moſt material and deciſive circumſtances, have equally contributed to perplex it.

In order to bring it to ſome iſſue, I have, in the 13th ſection, given a more full and regular deduction than had been given heretofore, of the phenomena of ſingle and double viſion, in thoſe whoſe ſight is perfect; and have traced them up to one general principle, which appears to be a law of viſion in human eyes that are perfect and in their natural ſtate.

In

In the 14th ſection I have made it appear, that this law of viſion, although excellently adapted to the fabric of human eyes, cannot anſwer the purpoſes of viſion in ſome other animals; and therefore, very probably, is not common to all animals. The purpoſe of the 15th and 16th ſections is, to inquire, whether there be any deviation from this law of viſion in thoſe who ſquint? a queſtion which is of real importance in the medical art, as well as in the philoſophy of viſion; but which, after all that hath been obſerved and written on the ſubject, ſeems not to be ripe for a determination, for want of proper obſervations. Thoſe who have had ſkill to make proper obſervations, have wanted opportunities; and thoſe who have had opportunities, have wanted ſkill or attention. I have therefore thought it worth while to give a diſtinct account of the obſervations neceſſary for the determination of this queſtion, and what concluſions may be drawn from the facts obſerved. I have likewiſe collected, and ſet in one view, the moſt concluſive facts that have occurred in authors, or have fallen under my own obſervation.

It muſt be confeſſed, that theſe facts, when applied to the queſtion in hand, make a very

poor figure; and the Gentlemen of the medical faculty are called upon, for the honour of their profeſſion, and for the benefit of mankind, to add to them.

All the medical, and all the optical writers, upon the *ſtrabiſmus*, that I have met with, except Dr JURIN, either affirm, or take it for granted, that ſquinting perſons ſee the object with both eyes, and yet ſee it ſingle. Dr JURIN affirms, that ſquinting perſons never ſee the object with both eyes; and that if they did, they would ſee it double. If the common opinion be true, the cure of a ſquint would be as pernicious to the ſight of the patient, as the cauſing of a permanent ſquint would be to one who naturally had no ſquint: and therefore no phyſician ought to attempt ſuch a cure; no patient ought to ſubmit to it. But if Dr JURIN's opinion be true, moſt young people that ſquint may cure themſelves, by taking ſome pains; and may not only remove the deformity, but at the ſame time improve their ſight. If the common opinion be true, the centres and other points of the two *retinæ* in ſquinting perſons do not correſpond as in other men, and nature in them deviates from her common rule. But if Dr JURIN's opinion be true, there is reaſon

ſon to think, that the ſame general law of viſion which we have found in perfect human eyes, extends alſo to thoſe which ſquint.

It is impoſſible to determine, by reaſoning, which of theſe opinions is true; or whether one may not be found true in ſome patients, and the other in others. Here, experience and obſervation are our only guides; and a deduction of inſtances, is the only rational argument. It might therefore have been expected, that the patrons of the contrary opinions ſhould have given inſtances, in ſupport of them, that are clear and indiſputable: but I have not found one ſuch inſtance on either ſide of the queſtion, in all the authors I have met with. I have given three inſtances from my own obſervation, in confirmation of Dr JURIN's opinion, which admit of no doubt; and one, which leans rather to the other opinion, but is dubious. And here I muſt leave the matter to further obſervation.

In the 17th ſection, I have endeavoured to ſhew, that the correſpondence and ſympathy of certain points of the two *retinæ*, into which we have reſolved all the phenomena of ſingle and double viſion, is not, as Dr SMITH conceived, the effect of cuſtom, nor can be changed by cuſtom, but is a natural and original property

property of human eyes: and in the laſt ſection, that it is not owing to an original and natural perception of the true diſtance of objects from the eye, as Dr PORTERFIELD imagined. After this recapitulation, which is intended to relieve the attention of the reader, ſhall we enter into more theories upon this ſubject?

That of Dr BRIGGS, firſt publiſhed in Engliſh, in the Philoſophical Tranſactions, afterwards in Latin, under the title of *Nova viſionis theoria*, with a prefatory epiſtle of Sir ISAAC NEWTON to the author, amounts to this, That the fibres of the optic nerves paſſing from correſponding points of the *retinæ* to the *thalami nervorum opticorum*, having the ſame length, the ſame tenſion, and a ſimilar ſituation, will have the ſame tone; and therefore their vibrations, excited by the impreſſion of the rays of light, will be like uniſons in muſic, and will preſent one and the ſame image to the mind: but the fibres paſſing from parts of the *retinæ*, which do not correſpond, having different tenſions and tones, will have diſcordant vibrations; and therefore preſent different images to the mind.

I ſhall not enter upon a particular examination of this theory. It is enough to obſerve,

ſerve, in general, that it is a ſyſtem of conjectures concerning things of which we are entirely ignorant; and that all ſuch theories in philoſophy deſerve rather to be laughed at, than to be ſeriouſly refuted.

From the firſt dawn of philoſophy to this day, it hath been believed that the optic nerves are intended to carry the images of viſible objects from the bottom of the eye to the mind; and that the nerves belonging to the organs of the other ſenſes have a like office. But how do we know this? We conjecture it: and taking this conjecture for a truth, we conſider how the nerves may beſt anſwer this purpoſe. The ſyſtem of the nerves, for many ages, was taken to be a hydraulic engine, conſiſting of a bundle of pipes, which carry to and fro a liquor called *animal ſpirits*. About the time of Dr BRIGGS, it was thought rather to be a ſtringed inſtrument, compoſed of vibrating chords, each of which had its proper tenſion and tone. But ſome, with as great probability, conceived it to be a wind inſtrument, which played its part by the vibrations of an elaſtic ether in the nervous fibrils.

Theſe, I think, are all the engines into which the nervous ſyſtem hath been mould-

ed

ed by philoſophers, for conveying the images of ſenſible things from the organ to the *ſenſorium*. And for all that we know of the matter, every man may freely chooſe which he thinks fitteſt for the purpoſe; for, from fact and experiment, no one of them can claim preference to another. Indeed, they all ſeem ſo unhandy engines for carrying images, that a man would be tempted to invent a new one.

Since, therefore, a blind man may gueſs as well in the dark as one that ſees, I beg leave to offer another conjecture touching the nervous ſyſtem, which I hope will anſwer the purpoſe as well as thoſe we have mentioned, and which recommends itſelf by its ſimplicity. Why may not the optic nerves, for inſtance, be made up of empty tubes, opening their mouths wide enough to receive the rays of light which form the image upon the *retina*, and gently conveying them ſafe, and in their proper order, to the very ſeat of the ſoul, until they flaſh in her face? It is eaſy for an ingenious philoſopher to fit the caliber of theſe empty tubes to the diameter of the particles of light, ſo as they ſhall receive no groſſer kind of matter. And if theſe rays ſhould be in danger of miſtaking their way, an expedient

pedient may alſo be found to prevent this. For it requires no more than to beſtow upon the tubes of the nervous ſyſtem a periſtaltic motion, like that of the alimentary tube.

It is a peculiar advantage of this hypotheſis, that, although all philoſophers believe that the ſpecies or images of things are conveyed by the nerves to the ſoul, yet none of their hypotheſes ſhew how this may be done. For how can the images of ſound, taſte, ſmell, colour, figure, and all ſenſible qualities, be made out of the vibrations of muſical chords, or the undulations of animal ſpirits, or of ether? We ought not to ſuppoſe means inadequate to the end. Is it not as philoſophical, and more intelligible, to conceive, that as the ſtomach receives its food, ſo the ſoul receives her images by a kind of nervous deglutition? I might add, that we need only continue this periſtaltic motion of the nervous tubes from the *ſenſorium* to the extremities of the nerves that ſerve the muſcles, in order to account for muſcular motion.

Thus nature will be conſonant to herſelf; and as ſenſation will be the conveyance of the ideal aliment to the mind, ſo muſcular motion will be the expulſion of the recrementitious part of it. For who can deny, that the images

ges of things conveyed by ſenſation, may, after due concoction, become fit to be thrown off by muſcular motion? I only give hints of theſe things to the ingenious, hoping that in time this hypotheſis may be wrought up into a ſyſtem as truly philoſophical, as that of animal ſpirits, or the vibration of nervous fibres.

To be ſerious: In the operations of nature, I hold the theories of a philoſopher, which are unſupported by fact, in the ſame eſtimation with the dreams of a man aſleep, or the ravings of a madman. We laugh at the Indian philoſopher, who, to account for the ſupport of the earth, contrived the hypotheſis of a huge elephant, and to ſupport the elephant, a huge tortoiſe. If we will candidly confeſs the truth, we know as little of the operation of the nerves, as he did of the manner in which the earth is ſupported; and our hypotheſes about animal ſpirits, or about the tenſion and vibrations of the nerves, are as like to be true, as his about the ſupport of the earth. His elephant was a hypotheſis, and our hypotheſes are elephants. Every theory in philoſophy, which is built on pure conjecture, is an elephant; and every theory that is ſupported partly by fact, and partly

ly by conjecture, is like Nebuchadnezzar's image, whoſe feet were partly of iron, and partly of clay.

The great NEWTON firſt gave an example to philoſophers, which always ought to be, but rarely hath been followed, by diſtinguiſhing his conjectures from his concluſions, and putting the former by themſelves, in the modeſt form of queries. This is fair and legal; but all other philoſophical traffic in conjecture, ought to be held contraband and illicit. Indeed his conjectures have commonly more foundation in fact, and more veriſimilitude, than the dogmatical theories of moſt other philoſophers; and therefore we ought not to omit that which he hath offered concerning the cauſe of our ſeeing objects ſingle with two eyes, in the 15th query annexed to his *Optics*.

" Are not the ſpecies of objects ſeen with " both eyes, united where the optic nerves " meet before they come into the brain, the " fibres on the right ſide of both nerves uni- " ting there, and after union going thence " into the brain in the nerve which is on the " right ſide of the head, and the fibres on the " left ſide of both nerves uniting in the ſame " place, and after union going into the brain

" in

" in the nerve which is on the left ſide of the " head; and theſe two nerves meeting in the " brain in ſuch a manner that their fibres " make but one entire ſpecies or picture, half " of which on the right ſide of the *ſenſorium* " comes from the right ſide of both eyes " through the right ſide of both optic nerves, " to the place where the nerves meet, and " from thence on the right ſide of the head " into the brain, and the other half on the " left ſide of the *ſenſorium* comes, in like " manner, from the left ſide of both eyes? " For the optic nerves of ſuch animals as " look the ſame way with both eyes, (as men, " dogs, ſheep, oxen, &c.), meet before they " come into the brain; but the optic nerves " of ſuch animals as do not look the ſame way " with both eyes, (as of fiſhes and of the cha- " meleon), do not meet, if I am rightly in- " formed."

I beg leave to diſtinguiſh this query into two, which are of very different natures; one being purely anatomical, the other relating to the carrying ſpecies or pictures of viſible objects to the *ſenſorium*.

The firſt queſtion is, Whether the fibres coming from correſponding points of the two *retinæ*, do not unite at the place where the optic

optic nerves meet, and continue united from thence to the brain; ſo that the right optic nerve, after the meeting of the two nerves, is compoſed of the fibres coming from the right ſide of both *retinæ*, and the left, of the fibres coming from the left ſide of both *retinæ*?

This is undoubtedly a curious and rational queſtion; becauſe, if we could find ground from anatomy to anſwer it in the affirmative, it would lead us a ſtep forward in diſcovering the cauſe of the correſpondence and ſympathy which there is between certain points of the two *retinæ*. For although we know not what is the particular function of the optic nerves, yet it is probable, that ſome impreſſion made upon them, and communicated along their fibres, is neceſſary to viſion: And whatever be the nature of this impreſſion, if two fibres are united into one, an impreſſion made upon one of them, or upon both, may probably produce the ſame effect. Anatomiſts think it a ſufficient account of a ſympathy between two parts of the body, when they are ſerved by branches of the ſame nerve: we ſhould therefore look upon it as an important diſcovery in anatomy, if it were found that the ſame nerve ſent branches to the correſponding points of the *retinæ*.

But hath any ſuch diſcovery been made? No, not ſo much as in one ſubject, as far as I can learn. But in ſeveral ſubjects, the contrary ſeems to have been diſcovered. Dr PORTERFIELD hath given us two caſes at length from VESALIUS, and one from CÆSALPINUS, wherein the optic nerves, after touching one another as uſual, appeared to be reflected back to the ſame ſide whence they came, without any mixture of their fibres. Each of theſe perſons had loſt an eye ſome time before his death, and the optic nerve belonging to that eye was ſhrunk, ſo that it could be diſtinguiſhed from the other at the place where they met. Another caſe which the ſame author gives from VESALIUS, is ſtill more remarkable; for in it the optic nerves did not touch at all; and yet, upon inquiry, thoſe who were moſt familiar with the perſon in his lifetime, declared that he never complained of any defect of ſight, or of his ſeeing objects double. DIEMERBROECK tells us, that AQUAPENDENS and VALVERDA likewiſe affirm, that they have met with ſubjects wherein the optic nerves did not touch.

As theſe obſervations were made before Sir ISAAC NEWTON put this query, it is uncertain whether he was ignorant of them, or whether he

he ſuſpected ſome inaccuracy in them, and deſired that the matter might be more carefully examined. But from the following paſſage of the moſt accurate WINSLOW, it does not appear, that later obſervations have been more favourable to his conjecture. "The union of "theſe [optic] nerves, by the ſmall curva- "tures of their *cornua*, is very difficult to be "unfolded in human bodies. This union is "commonly found to be very cloſe, but in "ſome ſubjects it ſeems to be no more than a "ſtrong adheſion, in others to be partly made "by an interſection or croſſing of fibres. "They have been found quite ſeparate; and "in other ſubjects, one of them has been "found to be very much altered both in ſize "and colour, through its whole paſſage, the "other remaining in its natural ſtate."

When we conſider this conjecture of Sir ISAAC NEWTON by itſelf, it appears more ingenious, and to have more veriſimilitude, than any thing that has been offered upon the ſubject; and we admire the caution and modeſty of the author, in propoſing it only as a ſubject of inquiry: but when we compare it with the obſervations of anatomiſts which contradict it, we are naturally led to this reflection, That if we truſt to the conjectures of men of the

greateſt genius in the operations of nature, we have only the chance of going wrong in an ingenious manner.

The ſecond part of the query is, Whether the two ſpecies of objects from the two eyes are not, at the place where the optic nerves meet, united into one ſpecies or picture, half of which is carried thence to the *ſenſorium* in the right optic nerve, and the other half in the left? and whether theſe two halves are not ſo put together again at the *ſenſorium*, as to make one ſpecies or picture?

Here it ſeems natural to put the previous queſtion, What reaſon have we to believe, that pictures of objects are at all carried to the *ſenſorium*, either by the optic nerves, or by any other nerves? Is it not poſſible, that this great philoſopher, as well as many of a lower form, having been led into this opinion at firſt by education, may have continued in it, becauſe he never thought of calling it in queſtion? I confeſs this was my own caſe for a conſiderable part of my life. But ſince I was led by accident to think ſeriouſly what reaſon I had to believe it, I could find none at all. It ſeems to be a mere hypotheſis, as much as the Indian philoſopher's elephant. I am not conſcious of any pictures of external objects in

in my *ſenſorium*, any more than in my ſtomach: the things which I perceive by my ſenſes, appear to be external, and not in any part of the brain; and my ſenſations, properly ſo called, have no reſemblance of external objects.

The concluſion from all that hath been ſaid, in no leſs than ſeven ſections, upon our ſeeing objects ſingle with two eyes, is this, That, by an original property of human eyes, objects painted upon the centres of the two *retinæ*, or upon points ſimilarly ſituate with regard to the centres, appear in the ſame viſible place; that the moſt plauſible attempts to account for this property of the eyes, have been unſucceſsful; and therefore, that it muſt be either a primary law of our conſtitution, or the conſequence of ſome more general law which is not yet diſcovered.

We have now finiſhed what we intended to ſay, both of the viſible appearances of things to the eye, and of the laws of our conſtitution by which thoſe appearances are exhibited. But it was obſerved, in the beginning of this chapter, that the viſible appearances of objects ſerve only as ſigns of their diſtance, magnitude, figure, and other tangible qualities. The viſible appearance, is that which is

preſented to the mind by nature, according to thoſe laws of our conſtitution, which have been explained. But the thing ſignified by that appearance, is that which is preſented to the mind by cuſtom.

When one ſpeaks to us in a language that is familiar, we hear certain ſounds, and this is all the effect that his diſcourſe has upon us by nature: but by cuſtom we underſtand the meaning of theſe ſounds; and therefore we fix our attention, not upon the ſounds, but upon the things ſignified by them. In like manner, we ſee only the viſible appearance of objects by nature; but we learn by cuſtom to interpret theſe appearances, and to underſtand their meaning. And when this viſual language is learned, and becomes familiar, we attend only to the things ſignified; and cannot, without great difficulty, attend to the ſigns by which they are preſented. The mind paſſes from one to the other ſo rapidly, and ſo familiarly, that no trace of the ſign is left in the memory, and we ſeem immediately, and without the intervention of any ſign, to perceive the thing ſignified.

When I look at the apple-tree, which ſtands before my window, I perceive, at the firſt glance, its diſtance and magnitude, the roughneſs

neſs of its trunk, the diſpoſition of its branches, the figure of its leaves and fruit. I ſeem to perceive all theſe things immediately. The viſible appearance which preſented them all to the mind, has entirely eſcaped me; I cannot, without great difficulty, and painful abſtraction, attend to it, even when it ſtands before me. Yet it is certain, that this viſible appearance only, is preſented to my eye by nature, and that I learned by cuſtom to collect all the reſt from it. If I had never ſeen before now, I ſhould not perceive either the diſtance or tangible figure of the tree, and it would have required the practice of ſeeing for many months, to change that original perception which nature gave me by my eyes, into that which I now have by cuſtom.

The objects which we ſee naturally and originally, as hath been before obſerved, have length and breadth, but no thickneſs, nor diſtance from the eye. Cuſtom, by a kind of legerdemain, withdraws gradually theſe original and proper objects of ſight, and ſubſtitutes in their place objects of touch, which have length, breadth, and thickneſs, and a determinate diſtance from the eye. By what means this change is brought about, and what prin-

ciples of the human mind concur in it, we are next to inquire.

SECT. XX.

Of perception in general.

SENSATION, and the perception of external objects by the ſenſes, though very different in their nature, have commonly been conſidered as one and the ſame thing. The purpoſes of common life do not make it neceſſary to diſtinguiſh them, and the received opinions of philoſophers tend rather to confound them: but, without attending carefully to this diſtinction, it is impoſſible to have any juſt conception of the operations of our ſenſes. The moſt ſimple operations of the mind, admit not of a logical definition: all we can do is to deſcribe them, ſo as to lead thoſe who are conſcious of them in themſelves, to attend to them, and reflect upon them; and it is often very difficult to deſcribe them ſo as to anſwer this intention.

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The ſame mode of expreſſion is uſed to denote ſenſation and perception; and therefore we are apt to look upon them as things of the ſame nature. Thus, *I feel a pain; I ſee a tree:* the firſt denoteth a ſenſation, the laſt a perception. The grammatical analyſis of both expreſſions is the ſame: for both conſiſt of an active verb and an object. But, if we attend to the things ſignified by theſe expreſſions, we ſhall find, that in the firſt, the diſtinction between the act and the object is not real but grammatical; in the ſecond, the diſtinction is not only grammatical but real.

The form of the expreſſion, *I feel pain*, might ſeem to imply, that the feeling is ſomething diſtinct from the pain felt; yet in reality, there is no diſtinction. As *thinking a thought* is an expreſſion which could ſignify no more than *thinking*, ſo *feeling a pain* ſignifies no more than *being pained.* What we have ſaid of pain is applicable to every other mere ſenſation. It is difficult to give inſtances, very few of our ſenſations having names; and where they have, the name being common to the ſenſation, and to ſomething elſe which is aſſociated with it. But when we attend to the ſenſation by itſelf, and ſeparate it from other things which are conjoined with

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it in the imagination, it appears to be ſomething which can have no exiſtence but in a ſentient mind, no diſtinction from the act of the mind by which it is felt.

Perception, as we here underſtand it, hath always an object diſtinct from the act by which it is perceived; an object which may exiſt whether it be perceived or not. I perceive a tree that grows before my window; there is here an object which is perceived, and an act of the mind by which it is perceived; and theſe two are not only diſtinguiſhable, but they are extremely unlike in their natures. The object is made up of a trunk, branches, and leaves; but the act of the mind, by which it is perceived, hath neither trunk, branches, nor leaves. I am conſcious of this act of my mind, and I can reflect upon it; but it is too ſimple to admit of an analyſis, and I cannot find proper words to deſcribe it. I find nothing that reſembles it ſo much as the remembrance of the tree, or the imagination of it. Yet both theſe differ eſſentially from perception; they differ likewiſe one from another. It is in vain that a philoſopher aſſures me, that the imagination of the tree, the remembrance of it, and the perception of it, are all one, and differ only in degree of vivacity. I know the contrary;

contrary; for I am as well acquainted with all the three, as I am with the apartments of my own houſe. I know this alſo, that the perception of an object implies both a conception of its form, and a belief of its preſent exiſtence. I know, moreover, that this belief is not the effect of argumentation and reaſoning; it is the immediate effect of my conſtitution.

I am aware, that this belief which I have in perception, ſtands expoſed to the ſtrongeſt batteries of ſcepticiſm. But they make no great impreſſion upon it. The ſceptic aſks me, Why do you believe the exiſtence of the external object which you perceive? This belief, Sir, is none of my manufacture; it came from the mint of nature; it bears her image and ſuperſcription; and, if it is not right, the fault is not mine: I even took it upon truſt, and without ſuſpicion. Reaſon, ſays the ſceptic, is the only judge of truth, and you ought to throw off every opinion and every belief that is not grounded on reaſon. Why, Sir, ſhould I believe the faculty of reaſon more than that of perception; they came both out of the ſame ſhop, and were made by the ſame artiſt; and if he puts one piece of falſe ware into my hands, what ſhould hinder him from putting another?

Perhaps

Perhaps the ſceptic will agree to diſtruſt reaſon, rather than give any credit to perception. For, ſays he, ſince, by your own conceſſion, the object which you perceive, and that act of your mind, by which you perceive it, are quite different things, the one may exiſt without the other; and as the object may exiſt without being perceived, ſo the perception may exiſt without an object. There is nothing ſo ſhameful in a philoſopher as to be deceived and deluded; and therefore you ought to reſolve firmly to withhold aſſent, and to throw off this belief of external objects, which may be all deluſion. For my part, I will never attempt to throw it off; and although the ſober part of mankind will not be very anxious to know my reaſons, yet if they can be of uſe to any ſceptic, they are theſe.

Firſt, Becauſe it is not in my power: why then ſhould I make a vain attempt? It would be agreeable to fly to the moon, and to make a viſit to Jupiter and Saturn; but when I know that nature has bound me down by the law of gravitation to this planet which I inhabit, I reſt contented, and quietly ſuffer myſelf to be carried along in its orbit. My belief is carried along by perception, as irreſiſtibly

bly as my body by the earth. And the greateſt ſceptic will find himſelf to be in the ſame condition. He may ſtruggle hard to diſbelieve the informations of his ſenſes, as a man does to ſwim againſt a torrent; but ah! it is in vain. It is in vain that he ſtrains every nerve, and wreſtles with nature, and with every object that ſtrikes upon his ſenſes. For after all, when his ſtrength is ſpent in the fruitleſs attempt, he will be carried down the torrent with the common herd of believers.

Secondly, I think it would not be prudent to throw off this belief, if it were in my power. If nature intended to deceive me, and impoſe upon me by falſe appearances, and I, by my great cunning and profound logic, have diſcovered the impoſture; prudence would dictate to me in this caſe, even to put up this indignity done me, as quietly as I could, and not to call her an impoſtor to her face, leſt ſhe ſhould be even with me in another way. For what do I gain by reſenting this injury? You ought at leaſt not to believe what ſhe ſays. This indeed ſeems reaſonable, if ſhe intends to impoſe upon me. But what is the conſequence? I reſolve not to believe my ſenſes. I break my noſe againſt a poſt that comes in

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my way; I ſtep into a dirty kennel; and, after twenty ſuch wiſe and rational actions, I am taken up and clapt into a mad-houſe. Now, I confeſs I would rather make one of the credulous fools whom nature impoſes upon, than of thoſe wiſe and rational philoſophers who reſolve to withhold aſſent at all this expence. If a man pretends to be a ſceptic with regard to the informations of ſenſe, and yet prudently keeps out of harm's way as other men do, he muſt excuſe my ſuſpicion, that he either acts the hypocrite, or impoſes upon himſelf. For if the ſcale of his belief were ſo evenly poiſed, as to lean no more to one ſide than to the contrary, it is impoſſible that his actions could be directed by any rules of common prudence.

Thirdly, Although the two reaſons already mentioned are perhaps two more than enough, I ſhall offer a third. I gave implicit belief to the informations of nature by my ſenſes, for a conſiderable part of my life, before I had learned ſo much logic as to be able to ſtart a doubt concerning them. And now, when I reflect upon what is paſt, I do not find that I have been impoſed upon by this belief. I find, that without it I muſt have periſhed by a thouſand accidents. I find, that without

out it I ſhould have been no wiſer now than when I was born. I ſhould not even have been able to acquire that logic which ſuggeſts theſe ſceptical doubts with regard to my ſenſes. Therefore, I conſider this inſtructive belief as one of the beſt gifts of nature. I thank the Author of my being who beſtowed it upon me, before the eyes of my reaſon were opened, and ſtill beſtows it upon me to be my guide, where reaſon leaves me in the dark. And now I yield to the direction of my ſenſes, not from inſtinct only, but from confidence and truſt in a faithful and beneficent Monitor, grounded upon the experience of his paternal care and goodneſs.

In all this, I deal with the Author of my being, no otherwiſe than I thought it reaſonable to deal with my parents and tutors. I believed by inſtinct whatever they told me, long before I had the idea of a lie, or thought of the poſſibility of their deceiving me. Afterwards, upon reflection, I found they had acted like fair and honeſt people who wiſhed me well. I found, that if I had not believed what they told me, before I could give a reaſon of my belief, I had to this day been little better than a changeling. And although this natural credulity hath ſometimes occaſioned

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my being impoſed upon by deceivers, yet it hath been of infinite advantage to me upon the whole; therefore I conſider it as another good gift of nature. And I continue to give that credit, from reflection, to thoſe of whoſe integrity and veracity I have had experience, which before I gave from inſtinct.

There is a much greater ſimilitude than is commonly imagined, between the teſtimony of nature given by our ſenſes, and the teſtimony of men given by language. The credit we give to both is at firſt the effect of inſtinct only. When we grow up, and begin to reaſon about them, the credit given to human teſtimony is reſtrained, and weakened, by the experience we have of deceit. But the credit given to the teſtimony of our ſenſes, is eſtabliſhed and confirmed by the uniformity and conſtancy of the laws of nature.

Our perceptions are of two kinds: ſome are natural and original, others acquired, and the fruit of experience. When I perceive that this is the taſte of cyder, that of brandy; that this is the ſmell of an apple, that of an orange; that this is the noiſe of thunder, that the ringing of bells; this the ſound of a coach paſſing, that the voice of ſuch a friend;

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theſe perceptions, and others of the ſame kind, are not original, they are acquired. But the perception which I have by touch, of the hardneſs and ſoftneſs of bodies, of their extenſion, figure, and motion, is not acquired; it is original.

In all our ſenſes, the acquired perceptions are many more than the original, eſpecially in ſight. By this ſenſe we perceive originally the viſible figure and colour of bodies only, and their viſible place: but we learn to perceive by the eye, almoſt every thing which we can perceive by touch. The original perceptions of this ſenſe, ſerve only as ſigns to introduce the acquired.

The ſigns by which objects are preſented to us in perception, are the language of nature to man; and as, in many reſpects, it hath great affinity with the language of man to man; ſo particularly in this, that both are partly natural and original, partly acquired by cuſtom. Our original or natural perceptions are analogous to the natural language of man to man, of which we took notice in the 4th chapter; and our acquired perceptions are analogous to artificial language, which, in our mother-tongue, is got very much in the ſame manner

with our acquired perceptions, as we ſhall afterwards more fully explain.

Not only men, but children, idiots, and brutes, acquire by habit many perceptions which they had not originally. Almoſt every employment in life, hath perceptions of this kind that are peculiar to it. The ſhepherd knows every ſheep of his flock, as we do our acquaintance, and can pick them out of another flock one by one. The butcher knows by ſight the weight and quality of his beeves and ſheep before they are killed. The farmer perceives by his eye, very nearly, the quantity of hay in a rick, or of corn in a heap. The ſailor ſees the burden, the built, and the diſtance of a ſhip at ſea, while ſhe is a great way off. Every man accuſtomed to writing, diſtinguiſhes his acquaintance by their handwriting, as he does by their faces. And the painter diſtinguiſhes in the works of his art, the ſtyle of all the great maſters. In a word, acquired perception is very different in different perſons, according to the diverſity of objects about which they are employed, and the application they beſtow in obſerving them.

Perception ought not only to be diſtinguiſhed from ſenſation, but likewiſe from that knowledge

ledge of the objects of ſenſe which is got by reaſoning. There is no reaſoning in perception, as hath been obſerved. The belief which is implied in it, is the effect of inſtinct. But there are many things, with regard to ſenſible objects, which we can infer from what we perceive; and ſuch concluſions of reaſon ought to be diſtinguiſhed from what is merely perceived. When I look at the moon, I perceive her to be ſometimes circular, ſometimes horned, and ſometimes gibbous. This is ſimple perception, and is the ſame in the philoſopher, and in the clown: but from theſe various appearances of her enlightened part, I infer that ſhe is really of a ſpherical figure. This concluſion is not obtained by ſimple perception, but by reaſoning. Simple perception has the ſame relation to the concluſions of reaſon drawn from our perceptions, as the axioms in mathematics have to the propoſitions. I cannot demonſtrate, that two quantities which are equal to the ſame quantity, are equal to each other; neither can I demonſtrate, that the tree which I perceive, exiſts. But, by the conſtitution of my nature, my belief is irreſiſtibly carried along by my apprehenſion of the axiom; and by the conſtitution of my nature, my belief is no leſs

irreſiſtibly carried along by my perception of the tree. All reaſoning is from principles. The firſt principles of mathematical reaſoning are mathematical axioms and definitions; and the firſt principles of all our reaſoning about exiſtences, are our perceptions. The firſt principles of every kind of reaſoning are given us by nature, and are of equal authority with the faculty of reaſon itſelf, which is alſo the gift of nature. The concluſions of reaſon are all built upon firſt principles, and can have no other foundation. Moſt juſtly, therefore, do ſuch principles diſdain to be tried by reaſon, and laugh at all the artillery of the logician, when it is directed againſt them.

When a long train of reaſoning is neceſſary in demonſtrating a mathematical propoſition, it is eaſily diſtinguiſhed from an axiom, and they ſeem to be things of a very different nature. But there are ſome propoſitions which lie ſo near to axioms, that it is difficult to ſay, whether they ought to be held as axioms, or demonſtrated as propoſitions. The ſame thing holds with regard to perception, and the concluſions drawn from it. Some of theſe concluſions follow our perceptions ſo eaſily, and are ſo immediately connected with them,

them, that it is difficult to fix the limit which divides the one from the other.

Perception, whether original or acquired, implies no exercise of reason; and is common to men, children, idiots, and brutes. The more obvious conclusions drawn from our perceptions, by reason, make what we call *common understanding;* by which men conduct themselves in the common affairs of life, and by which they are distinguished from idiots. The more remote conclusions which are drawn from our perceptions, by reason, make what we commonly call *science* in the various parts of nature, whether in agriculture, medicine, mechanics, or in any part of natural philosophy. When I see a garden in good order, containing a great variety of things of the best kinds, and in the most flourishing condition, I immediately conclude from these signs, the skill and industry of the gardener. A farmer, when he rises in the morning, and perceives that the neighbouring brook overflows his field, concludes that a great deal of rain hath fallen in the night. Perceiving his fence broken, and his corn trodden down, he concludes that some of his own or his neighbours cattle have broke loose. Perceiving that his stable-door is broke open, and some of his

horſes gone, he concludes that a thief has carried them off. He traces the prints of his horſes feet in the ſoft ground, and by them diſcovers which road the thief hath taken. Theſe are inſtances of common underſtanding, which dwells ſo near to perception, that it is difficult to trace the line which divides the one from the other. In like manner, the ſcience of nature dwells ſo near to common underſtanding, that we cannot diſcern where the latter ends and the former begins. I perceive that bodies, lighter than water, ſwim in water, and that thoſe which are heavier ſink. Hence I conclude, that if a body remains wherever it is put under water, whether at the top or bottom, it is preciſely of the ſame weight with water. If it will reſt only when part of it is above water, it is lighter than water. And the greater the part above water is, compared with the whole, the lighter is the body. If it had no gravity at all, it would make no impreſſion upon the water, but ſtand wholly above it. Thus, every man, by common underſtanding, has a rule by which he judges of the ſpecific gravity of bodies which ſwim in water: and a ſtep or two more leads him into the ſcience of hydroſtatics.

All

All that we know of nature, or of exiſtences, may be compared to a tree, which hath its root, trunk, and branches. In this tree of knowledge, perception is the root, common underſtanding is the trunk, and the ſciences are the branches.

SECT. XXI.

Of the proceſs of Nature in perception.

ALTHOUGH there is no reaſoning in perception, yet there are certain means and inſtruments, which, by the appointment of nature, muſt intervene between the object and our perception of it; and, by theſe our perceptions are limited and regulated. Firſt, if the object is not in contact with the organ of ſenſe, there muſt be ſome medium which paſſes between them. Thus, in viſion, the rays of light; in hearing, the vibrations of elaſtic air; in ſmelling, the effluvia of the body ſmelled, muſt paſs from the object to the organ; otherwiſe we have no perception. Se-

condly, There must be some action or impression upon the organ of sense, either by the immediate application of the object, or by the medium that goes between them. Thirdly, The nerves which go from the brain to the organ, must receive some impression by means of that which was made upon the organ; and probably, by means of the nerves, some impression must be made upon the brain. Fourthly, The impression made upon the organ, nerves, and brain, is followed by a sensation. And, last of all, This sensation is followed by the perception of the object.

Thus our perception of objects is the result of a train of operations; some of which affect the body only, others affect the mind. We know very little of the nature of some of these operations; we know not at all how they are connected together, or in what way they contribute to that perception which is the result of the whole: but, by the laws of our constitution, we perceive objects in this, and in no other way.

There may be other beings, who can perceive external objects without rays of light, or vibrations of air, or effluvia of bodies, without impressions on bodily organs, or even without sensations: but we are so framed by the Author of Nature, that even when we are surrounded

ſurrounded by external objects, we may perceive none of them. Our faculty of perceiving an object lies dormant, until it is rouſed and ſtimulated by a certain correſponding ſenſation. Nor is this ſenſation always at hand to perform its office; for it enters into the mind only in conſequence of a certain correſponding impreſſion made on the organ of ſenſe by the object.

Let us trace this correſpondence of impreſſions, ſenſations, and perceptions, as far as we can; beginning with that which is firſt in order, the impreſſion made upon the bodily organ. But, alas! we know not of what nature theſe impreſſions are, far leſs how they excite ſenſations in the mind.

We know that one body may act upon another by preſſure, by percuſſion, by attraction, by repulſion, and probably in many other ways, which we neither know, nor have names to expreſs. But in which of theſe ways objects, when perceived by us, act upon the organs of ſenſe, theſe organs upon the nerves, and the nerves upon the brain, we know not. Can any man tell me how, in viſion, the rays of light act upon the *retina*, how the *retina* acts upon the optic nerve, and how the optic nerve acts upon the brain? No man can.

When

When I feel the pain of the gout in my toe, I know that there is ſome unuſual impreſſion made upon that part of my body. But of what kind is it? Are the ſmall veſſels diſtended with ſome redundant elaſtic, or unelaſtic fluid? Are the fibres unuſually ſtretched? Are they torn aſunder by force, or gnawed and corroded by ſome acrid humour? I can anſwer none of theſe queſtions. All that I feel, is pain, which is not an impreſſion upon the body, but upon the mind; and all that I perceive by this ſenſation is, that ſome diſtemper in my toe occaſions this pain. But as I know not the natural temper and texture of my toe when it is at eaſe, I know as little what change or diſorder of its parts occaſions this uneaſy ſenſation. In like manner, in every other ſenſation, there is, without doubt, ſome impreſſion made upon the organ of ſenſe; but an impreſſion of which we know not the nature. It is too ſubtile to be diſcovered by our ſenſes, and we may make a thouſand conjectures without coming near the truth. If we underſtood the ſtructure of our organs of ſenſe ſo minutely, as to diſcover what effects are produced upon them by external objects, this knowledge would contribute nothing to our perception of the object; for they perceive

ceive as distinctly who know least about the manner of perception, as the greatest adepts. It is necessary that the impression be made upon our organs, but not that it be known. Nature carries on this part of the process of perception, without our consciousness or concurrence.

But we cannot be unconscious of the next step in this process, the sensation of the mind, which always immediately follows the impression made upon the body. It is essential to a sensation to be felt, and it can be nothing more than we feel it to be. If we can only acquire the habit of attending to our sensations, we may know them perfectly. But how are the sensations of the mind produced by impressions upon the body? Of this we are absolutely ignorant, having no means of knowing how the body acts upon the mind, or the mind upon the body. When we consider the nature and attributes of both, they seem to be so different, and so unlike, that we can find no handle by which the one may lay hold of the other. There is a deep and dark gulf between them, which our understanding cannot pass; and the manner of their correspondence and intercourse is absolutely unknown.

Experience

Experience teaches us, that certain impreſſions upon the body are conſtantly followed by certain ſenſations of the mind; and that, on the other hand, certain determinations of the mind are conſtantly followed by certain motions in the body: but we ſee not the chain that ties theſe things together. Who knows but their connection may be arbitrary, and owing to the will of our Maker? Perhaps the ſame ſenſations might have been connected with other impreſſions, or other bodily organs. Perhaps we might have been ſo made, as to taſte with our fingers, to ſmell with our ears, and to hear by the noſe. Perhaps we might have been ſo made, as to have all the ſenſations and perceptions which we have, without any impreſſion made upon our bodily organs at all.

However theſe things may be, if nature had given us nothing more than impreſſions made upon the body, and ſenſations in our minds correſponding to them, we ſhould in that caſe have been merely ſentient, but not percipient beings. We ſhould never have been able to form a conception of any external object, far leſs a belief of its exiſtence. Our ſenſations have no reſemblance to external objects; nor can we diſcover, by our reaſon, any neceſſary

neceſſary connection between the exiſtence of the former, and that of the latter.

We might perhaps have been made of ſuch a conſtitution, as to have our preſent perceptions connected with other ſenſations. We might perhaps have had the perception of external objects, without either impreſſions upon the organs of ſenſe, or ſenſations. Or, laſtly, The perceptions we have, might have been immediately connected with the impreſſions upon our organs, without any intervention of ſenſations. This laſt ſeems really to be the caſe in one inſtance, to wit, in our perception of the viſible figure of bodies, as was obſerved in the 8th ſection of this chapter.

The proceſs of nature in perception by the ſenſes, may therefore be conceived as a kind of drama, wherein ſome things are performed behind the ſcenes, others are repreſented to the mind in different ſcenes, one ſucceeding another. The impreſſion made by the object upon the organ, either by immediate contact, or by ſome intervening medium, as well as the impreſſion made upon the nerves and brain, is performed behind the ſcenes, and the mind ſees nothing of it. But every ſuch impreſſion, by the laws of the drama, is followed by a ſenſation, which is the firſt ſcene exhibited

ted to the mind; and this ſcene is quickly ſucceeded by another, which is the perception of the object.

In this drama, nature is the actor, we are the ſpectators. We know nothing of the machinery by means of which every different impreſſion upon the organ, nerves, and brain, exhibits its correſponding ſenſation; or of the machinery by means of which each ſenſation exhibits its correſponding perception. We are inſpired with the ſenſation, and we are inſpired with the correſponding perception, by means unknown. And becauſe the mind paſſes immediately from the ſenſation to that conception and belief of the object which we have in perception, in the ſame manner as it paſſes from ſigns to the things ſignified by them, we have therefore called our ſenſations *ſigns of external objects*; finding no word more proper to expreſs the function which nature hath aſſigned them in perception, and the relation which they bear to their correſponding objects.

There is no neceſſity of a reſemblance between the ſign and the thing ſignified: and indeed no ſenſation can reſemble any external object. But there are two things neceſſary to our knowing things by means of ſigns. Firſt,

That

That a real connection between the ſign and thing ſignified be eſtabliſhed, either by the courſe of nature, or by the will and appointment of men. When they are connected by the courſe of nature, it is a natural ſign; when by human appointment, it is an artificial ſign. Thus, ſmoke is a natural ſign of fire; certain features are natural ſigns of anger: but our words, whether expreſſed by articulate ſounds or by writing, are artificial ſigns of our thoughts and purpoſes.

Another requiſite to our knowing things by ſigns is, that the appearance of the ſign to the mind, be followed by the conception and belief of the thing ſignified. Without this, the ſign is not underſtood or interpreted; and therefore is no ſign to us, however fit in its own nature for that purpoſe.

Now, there are three ways in which the mind paſſes from the appearance of a natural ſign to the conception and belief of the thing ſignified; by original principles of our conſtitution, by cuſtom, and by reaſoning.

Our original perceptions are got in the firſt of theſe ways, our acquired perceptions in the ſecond, and all that reaſon diſcovers of the courſe of nature, in the third. In the firſt of theſe ways, nature, by means of the ſenſations

of

of touch, informs us of the hardneſs and ſoftneſs of bodies; of their extenſion, figure, and motion; and of that ſpace in which they move and are placed, as hath been already explained in the fifth chapter of this inquiry. And in the ſecond of theſe ways ſhe informs us, by means of our eyes, of almoſt all the ſame things which originally we could perceive only by touch.

In order, therefore, to underſtand more particularly how we learn to perceive ſo many things by the eye, which originally could be perceived only by touch, it will be proper, firſt, To point out the ſigns by which thoſe things are exhibited to the eye, and their connection with the things ſignified by them; and, ſecondly, To conſider how the experience of this connection produces that habit by which the mind, without any reaſoning or reflection, paſſes from the ſign to the conception and belief of the thing ſignified.

Of all the acquired perceptions which we have by ſight, the moſt remarkable is the perception of the diſtance of objects from the eye; we ſhall therefore particularly conſider the ſigns by which this perception is exhibited, and only make ſome general remarks with regard

regard to the ſigns which are uſed in other acquired perceptions.

SECT. XXII.

Of the ſigns by which we learn to perceive diſtance from the eye.

IT was before obſerved in general, That the original perceptions of ſight are ſigns which ſerve to introduce thoſe that are acquired: but this is not to be underſtood as if no other ſigns were employed for that purpoſe. There are ſeveral motions of the eyes, which, in order to diſtinct viſion, muſt be varied, according as the object is more or leſs diſtant; and ſuch motions being by habit connected with the correſponding diſtances of the object, become ſigns of thoſe diſtances. Theſe motions were at firſt voluntary and unconfined; but as the intention of nature was, to produce perfect and diſtinct viſion by their means, we ſoon learn by experience to regulate them ac-

cording to that intention only, without the leaſt reflection.

A ſhip requires a different trim for every variation of the direction and ſtrength of the wind: and, if we may be allowed to borrow that word, the eyes require a different trim for every degree of light, and for every variation of the diſtance of the object, while it is within certain limits. The eyes are trimmed for a particular object, by contracting certain muſcles, and relaxing others; as the ſhip is trimmed for a particular wind, by drawing certain ropes and ſlackening others. The ſailor learns the trim of his ſhip, as we learn the trim of our eyes, by experience. A ſhip, although the nobleſt machine that human art can boaſt, is far inferior to the eye in this reſpect, that it requires art and ingenuity to navigate her; and a ſailor muſt know what ropes he muſt pull, and what he muſt ſlacken, to fit her to a particular wind: but with ſuch ſuperior wiſdom is the fabric of the eye, and the principles of its motion contrived, that it requires no art nor ingenuity to ſee by it. Even that part of viſion which is got by experience, is attained by idiots. We need not know what muſcles we are to contract, and what

what we are to relax, in order to fit the eye to a particular diſtance of the object.

But although we are not conſcious of the motions we perform, in order to fit the eyes to the diſtance of the object, we are conſcious of the effort employed in producing theſe motions; and probably have ſome ſenſation which accompanies them, to which we give as little attention as to other ſenſations. And thus, an effort conſciouſly exerted, or a ſenſation conſequent upon that effort, comes to be conjoined with the diſtance of the object which gave occaſion to it, and by this conjunction becomes a ſign of that diſtance. Some inſtances of this will appear in conſidering the means or ſigns by which we learn to ſee the diſtance of objects from the eye. In the enumeration of theſe, we agree with Dr PORTERFIELD, notwithſtanding that diſtance from the eye, in his opinion, is perceived originally, but in our opinion, by experience only.

In general, when a near object affects the eye in one manner, and the ſame object, placed at a greater diſtance, affects it in a different manner; theſe various affections of the eye become ſigns of the correſponding diſtances. The means of perceiving diſtance by the eye, will therefore be explained, by ſhew-

ing in what various ways objects affect the eye differently, according to their proximity or distance.

1. It is well known, that to see objects distinctly at various distances, the form of the eye must undergo some change. And nature hath given us the power of adapting it to near objects, by the contraction of certain muscles, and to distant objects, by the contraction of other muscles. As to the manner in which this is done, and the muscular parts employed, anatomists do not altogether agree. The ingenious Dr JURIN, in his excellent essay on distinct and indistinct vision, seems to have given the most probable account of this matter; and to him I refer the reader.

But whatever be the manner in which this change of the form of the eye is effected, it is certain that young people have commonly the power of adapting their eyes to all the distances of the object, from six to seven inches, to fifteen or sixteen feet; so as to have perfect and distinct vision at any distance within these limits. From this it follows, that the effect we consciously employ to adapt the eye to any particular distance of objects within these limits, will be connected and associated with that distance, and will become a sign of

it.

it. When the object is removed beyond the farthest limit of distinct vision, it will be seen indistinctly; but more or less so, according as its distance is greater or less: so that the degrees of indistinctness of the object may become the signs of distances considerably beyond the farthest limit of distinct vision.

If we had no other mean but this, of perceiving distance of visible objects, the most distant would not appear to be above twenty or thirty feet from the eye, and the tops of houses and trees would seem to touch the clouds; for in that case the signs of all greater distances being the same, they have the same signification, and give the same perception of distance.

But it is of more importance to observe, that because the nearest limit of distinct vision in the time of youth, when we learn to perceive distance by the eye, is about six or seven inches, no object seen distinctly, ever appears to be nearer than six or seven inches from the eye. We can, by art, make a small object appear distinct, when it is in reality not above half an inch from the eye; either by using a single microscope, or by looking through a small pin-hole in a card. When, by either of these means, an object is made to

appear diſtinct, however ſmall its diſtance is in reality, it ſeems to be removed at leaſt to the diſtance of ſix or ſeven inches, that is, within the limits of diſtinct viſion.

This obſervation is the more important, becauſe it affords the only reaſon we can give why an object is magnified either by a ſingle microſcope, or by being ſeen through a pin-hole; and the only mean by which we can aſcertain the degree in which the object will be magnified by either. Thus, if the object is really half an inch diſtant from the eye, and appears to be ſeven inches diſtant, its diameter will ſeem to be enlarged in the ſame proportion as its diſtance, that is, fourteen times.

2. In order to direct both eyes to an object, the optic axes muſt have a greater or leſs inclination, according as the object is nearer or more diſtant. And although we are not conſcious of this inclination, yet we are conſcious of the effort employed in it. By this mean we perceive ſmall diſtances more accurately than we could do by the conformation of the eye only. And therefore we find, that thoſe who have loſt the ſight of one eye, are apt, even within arm's-length, to make miſtakes in the diſtance of objects, which are eaſily avoided

voided by thoſe who ſee with both eyes. Such miſtakes are often diſcovered in ſnuffing a candle, in threading a needle, or in filling a tea-cup.

When a picture is ſeen with both eyes, and at no great diſtance, the repreſentation appears not ſo natural as when it is ſeen only with one. The intention of painting being to deceive the eye, and to make things appear at different diſtances which in reality are upon the ſame piece of canvas, this deception is not ſo eaſily put upon both eyes as upon one; becauſe we perceive the diſtance of viſible objects more exactly and determinately with two eyes than with one. If the ſhading and relief be executed in the beſt manner, the picture may have almoſt the ſame appearance to one eye as the objects themſelves would have, but it cannot have the ſame appearance to both. This is not the fault of the artiſt, but an unavoidable imperfection in the art. And it is owing to what we juſt now obſerved, that the perception we have of the diſtance of objects by one eye is more uncertain, and more liable to deception, than that which we have by both.

The great impediment, and I think the only invincible impediment, to that agreeable

deception of the eye which the painter aims at, is the perception which we have of the diſtance of viſible objects from the eye, partly by means of the conformation of the eye, but chiefly by means of the inclination of the optic axes. If this perception could be removed, I ſee no reaſon why a picture might not be made ſo perfect as to deceive the eye in reality, and to be miſtaken for the original object. Therefore, in order to judge of the merit of a picture, we ought, as much as poſſible, to exclude theſe two means of perceiving the diſtance of the ſeveral parts of it.

In order to remove this perception of diſtance, the connoiſſeurs in painting uſe a method which is very proper. They look at the picture with one eye, through a tube which excludes the view of all other objects. By this method, the principal mean whereby we perceive the diſtance of the object, to wit, the inclination of the optic axes, is entirely excluded. I would humbly propoſe, as an improvement of this method of viewing pictures, that the aperture of the tube next to the eye ſhould be very ſmall. If it is as ſmall as a pin-hole, ſo much the better, providing there be light enough to ſee the picture clearly. The reaſon of this propoſal is, that when we

we look at an object through a ſmall aperture, it will be ſeen diſtinctly, whether the conformation of the eye be adapted to its diſtance or not, and we have no mean left to judge of the diſtance, but the light and colouring, which are in the painter's power. If, therefore, the artiſt performs his part properly, the picture will by this method affect the eye in the ſame manner that the object repreſented would do; which is the perfection of this art.

Although this ſecond mean of perceiving the diſtance of viſible objects be more determinate and exact than the firſt, yet it hath its limits, beyond which it can be of no uſe. For when the optic axes directed to an object are ſo nearly parallel, that in directing them to an object yet more diſtant, we are not conſcious of any new effort, nor have any different ſenſation; there our perception of diſtance ſtops; and as all more diſtant objects affect the eye in the ſame manner, we perceive them to be at the ſame diſtance. This is the reaſon why the ſun, moon, planets, and fixed ſtars, when ſeen not near the horizon, appear to be all at the ſame diſtance, as if they touched the concave ſurface of a great ſphere. The ſurface of this celeſtial ſphere

is

is at that diſtance beyond which all objects affect the eye in the ſame manner. Why this celeſtial vault appears more diſtant towards the horizon, than towards the zenith, will afterwards appear.

3. The colours of objects, according as they are more diſtant, become more faint and languid, and are tinged more with the azure of the intervening atmoſphere: to this we may add, that their minute parts become more indiſtinct, and their outline leſs accurately defined. It is by theſe means chiefly, that painters can repreſent objects at very different diſtances, upon the ſame canvas. And the diminution of the magnitude of an object, would not have the effect of making it appear to be at a great diſtance without this degradation of colour, and indiſtinctneſs of the outline, and of the minute parts. If a painter ſhould make a human figure ten times leſs than other human figures that are in the ſame piece, having the colours as bright, and the outline and minute parts as accurately defined, it would not have the appearance of a man at a great diſtance, but of a pigmy or Lilliputian.

When an object hath a known variety of colours, its diſtance is more clearly indicated by

by the gradual dilution of the colours into one another, than when it is of one uniform colour. In the ſteeple which ſtands before me at a ſmall diſtance, the joining of the ſtones are clearly perceptible; the gray colour of the ſtone, and the white cement, are diſtinctly limited: when I ſee it at a greater diſtance, the joinings of the ſtones are leſs diſtinct, and the colours of the ſtone and of the cement begin to dilute into one another: at a diſtance ſtill greater, the joinings diſappear altogether, and the variety of colour vaniſhes.

In an apple-tree which ſtands at the diſtance of about twelve feet, covered with flowers, I can perceive the figure and the colour of the leaves and petals; pieces of branches, ſome larger, others ſmaller, peeping through the interval of the leaves, ſome of them enlightened by the ſun's rays, others ſhaded; and ſome openings of the ſky are perceived through the whole. When I gradually remove from this tree, the appearance, even as to colour, changes every minute. Firſt, the ſmaller parts, then the larger, are gradually confounded and mixed. The colours of leaves, petals, branches, and ſky, are gradually diluted into each other, and the colour of the whole becomes more and more uniform.

This

This change of appearance, correſponding to the ſeveral diſtances, marks the diſtance more exactly than if the whole object had been of one colour.

Dr SMITH, in his Optics, gives us a very curious obſervation made by Biſhop BERKELEY, in his travels through Italy and Sicily. He obſerved, That in thoſe countries, cities and palaces ſeen at a great diſtance, appeared nearer to him by ſeveral miles than they really were: and he very judiciouſly imputed it to this cauſe, That the purity of the Italian and Sicilian air, gave to very diſtant objects, that degree of brightneſs and diſtinctneſs, which, in the groſſer air of his own country, was to be ſeen only in thoſe that are near. The purity of the Italian air has been aſſigned as the reaſon why the Italian painters commonly give a more lively colour to the ſky, than the Flemiſh. Ought they not, for the ſame reaſon, to give leſs degradation of the colours, and leſs indiſtinctneſs of the minute parts, in the repreſentation of very diſtant objects?

It is very certain, that as, in air uncommonly pure, we are apt to think viſible objects nearer, and leſs than they really are; ſo, in air uncommonly foggy, we are apt to think them

them more diſtant, and larger than the truth. Walking by the ſea-ſide, in a thick fog, I ſee an object which ſeems to me to be a man on horſeback, and at the diſtance of about half a mile. My companion, who has better eyes, or is more accuſtomed to ſee ſuch objects in ſuch circumſtances, aſſures me, that it is a ſea-gull, and not a man on horſeback. Upon a ſecond view, I immediately aſſent to his opinion; and now it appears to me to be a ſea-gull, and at the diſtance only of ſeventy or eighty yards. The miſtake made on this occaſion, and the correction of it, are both ſo ſudden, that we are at a loſs whether to call them by the name of *judgment*, or by that of *ſimple perception*.

It is not worth while to diſpute about names; but it is evident, that my belief, both firſt and laſt, was produced rather by ſigns than by arguments; and that the mind proceeded to the concluſion in both caſes by habit, and not by ratiocination. And the proceſs of the mind ſeems to have been this. Firſt, not knowing, or not minding, the effect of a foggy air on the viſible appearance of objects, the object ſeems to me to have that degradation of colour, and that indiſtinctneſs of the outline, which objects have at the diſtance

ſtance of half a mile; therefore, from the viſible appearance as a ſign, I immediately proceed to the belief, that the object is half a mile diſtant. Then, this diſtance, together with the viſible magnitude, ſignify to me the real magnitude, which, ſuppoſing the diſtance to be half a mile, muſt be equal to that of a man on horſeback; and the figure, conſidering the indiſtinctneſs of the outline, agrees with that of a man on horſeback. Thus the deception is brought about. But when I am aſſured that it is a ſea-gull, the real magnitude of a ſea-gull, together with the viſible magnitude preſented to the eye, immediately ſuggeſt the diſtance, which in this caſe cannot be above ſeventy or eighty yards: the indiſtinctneſs of the figure likewiſe ſuggeſts the fogginess of the air as its cauſe: and now the whole chain of ſigns, and things ſignified, ſeems ſtronger and better connected than it was before; the half mile vaniſhes to eighty yards; the man on horſeback dwindles to a ſea-gull; I get a new perception, and wonder how I got the former, or what is become of it; for it is now ſo entirely gone, that I cannot recover it.

It ought to be obſerved, that in order to produce ſuch deceptions from the clearneſs or fogginess

fogginess of the air, it must be uncommonly clear, or uncommonly foggy: for we learn from experience, to make allowance for that variety of constitutions of the air which we have been accustomed to observe, and of which we are aware. Bishop BERKELEY, therefore, committed a mistake, when he attributed the large appearance of the horizontal moon to the faintness of her light, occasioned by its passing through a larger tract of atmosphere: for we are so much accustomed to see the moon in all degrees of faintness and brightness, from the greatest to the least, that we learn to make allowance for it; and do not imagine her magnitude increased by the faintness of her appearance. Besides, it is certain, that the horizontal moon, seen through a tube which cuts off the view of the interjacent ground, and of all terrestrial objects, loses all that unusual appearance of magnitude.

4. We frequently perceive the distance of objects, by means of intervening or contiguous objects, whose distance or magnitude is otherwise known. When I perceive certain fields or tracts of ground to lie between me and an object, it is evident, that these may become signs of its distance. And although we

we have no particular information of the dimenſions of ſuch fields or tracts, yet their ſimilitude to others which we know, ſuggeſts their dimenſions.

We are ſo much accuſtomed to meaſure with our eye the ground which we travel, and to compare the judgments of diſtances formed by ſight, with our experience or information, that we learn by degrees, in this way, to form a more accurate judgment of the diſtance of terreſtrial objects, than we could do by any of the means before mentioned. An object placed upon the top of a high building, appears much leſs than when placed upon the ground at the ſame diſtance. When it ſtands upon the ground, the intervening tract of ground ſerves as a ſign of its diſtance; and the diſtance, together with the viſible magnitude, ſerves as a ſign of its real magnitude. But when the object is placed on high, this ſign of its diſtance is taken away: the remaining ſigns lead us to place it at a leſs diſtance; and this leſs diſtance, together with the viſible magnitude, becomes a ſign of a leſs real magnitude.

The two firſt means we have mentioned, would never of themſelves make a viſible object appear above a hundred and fifty, or two hundred

hundred feet, diſtant; becauſe, beyond that there is no ſenſible change, either of the conformation of the eyes, or of the inclination of their axes. The third mean, is but a vague and undeterminate ſign, when applied to diſtances above two or three hundred feet, unleſs we know the real colour and figure of the object; and the fifth mean, to be afterwards mentioned, can only be applied to objects which are familiar, or whoſe real magnitude is known. Hence it follows, that when unknown objects, upon, or near the ſurface of the earth, are perceived to be at the diſtance of ſome miles, it is always by this fourth mean that we are led to that concluſion.

Dr SMITH hath obſerved, very juſtly, that the known diſtance of the terreſtrial objects which terminate our view, makes that part of the ſky which is towards the horizon, appear more diſtant than that which is towards the zenith. Hence it comes to paſs, that the apparent figure of the ſky is not that of a hemiſphere, but rather a leſs ſegment of a ſphere. And hence likewiſe it comes to paſs, that the diameter of the ſun or moon, or the diſtance between two fixed ſtars, ſeen contiguous to a hill, or to any diſtant terreſtrial object, ap-

pears much greater than when no ſuch object ſtrikes the eye at the ſame time.

Theſe obſervations have been ſufficiently explained and confirmed by Dr SMITH. I beg leave to add, that when the viſible horizon is terminated by very diſtant objects, the celeſtial vault ſeems to be enlarged in all its dimenſions. When I view it from a confined ſtreet or lane, it bears ſome proportion to the buildings that ſurround me: but when I view it from a large plain, terminated on all hands by hills which riſe one above another, to the diſtance of twenty miles from the eye, methinks I ſee a new heaven, whoſe magnificence declares the greatneſs of its Author, and puts every human edifice out of countenance; for now the lofty ſpires and the gorgeous palaces ſhrink into nothing before it, and bear no more proportion to the celeſtial dome, than their makers bear to its Maker.

5. There remains another mean by which we perceive the diſtance of viſible objects, and that is, the diminution of their viſible or apparent magnitude. By experience, I know what figure a man, or any other known object, makes to my eye, at the diſtance of ten feet: I perceive the gradual and proportional diminution of this viſible figure, at the diſtance

ſtance of twenty, forty, a hundred feet, and at greater diſtances, until it vaniſh altogether. Hence a certain viſible magnitude of a known object, becomes the ſign of a certain determinate diſtance, and carries along with it the conception and belief of that diſtance.

In this proceſs of the mind, the ſign is not a ſenſation; it is an original perception. We perceive the viſible figure and viſible magnitude of the object, by the original powers of viſion; but the viſible figure is uſed only as a ſign of the real figure, and the viſible magnitude is uſed only as a ſign either of the diſtance, or of the real magnitude, of the object; and therefore theſe original perceptions, like other mere ſigns, paſs through the mind, without any attention or reflection.

This laſt mean of perceiving the diſtance of known objects, ſerves to explain ſome very remarkable phenomena in optics, which would otherwiſe appear very myſterious. When we view objects of known dimenſions through optical glaſſes, there is no other mean left of determining their diſtance, but this fifth. Hence it follows, that known objects, ſeen

through glaſſes, muſt ſeem to be brought nearer, in proportion to the magnifying power of the glaſs, or to be removed to a greater diſtance, in proportion to the diminiſhing power of the glaſs.

If a man who had never before ſeen objects through a teleſcope, were told, that the teleſcope, which he is about to uſe, magnifies the diameter of the object ten times; when he looks through this teleſcope at a man ſix feet high, what would he expect to ſee? Surely he would very naturally expect to ſee a giant ſixty feet high. But he ſees no ſuch thing. The man appears no more than ſix feet high, and conſequently no bigger than he really is; but he appears ten times nearer than he is. The teleſcope indeed magnifies the image of this man upon the *retina* ten times in diameter, and muſt therefore magnify his viſible figure in the ſame proportion; and as we have been accuſtomed to ſee him of this viſible magnitude, when he was ten times nearer than he is preſently, and in no other caſe; this viſible magnitude, therefore, ſuggeſts the conception and belief of that diſtance of the object with which it hath been always connected. We have been accuſtomed to conceive this

this amplification of the visible figure of a known object, only as the effect or sign of its being brought nearer: and we have annexed a certain determinate distance to every degree of visible magnitude of the object; and therefore, any particular degree of visible magnitude, whether seen by the naked eye or by glasses, brings along with it the conception and belief of the distance which corresponds to it. This is the reason why a telescope seems not to magnify known objects, but to bring them nearer to the eye.

When we look through a pin-hole, or a single microscope, at an object which is half an inch from the eye, the picture of the object upon the *retina* is not enlarged, but only rendered distinct; neither is the visible figure enlarged: yet the object appears to the eye twelve or fourteen times more distant, and as many times larger in diameter, than it really is. Such a telescope as we have mentioned, amplifies the image on the *retina*, and the visible figure of the object, ten times in diameter, and yet makes it seem no bigger, but only ten times nearer. These appearances had been long observed by the writers on optics; they tortured their invention to find the causes of them

from optical principles; but in vain: they muſt be reſolved into habits of perception, which are acquired by cuſtom, but are apt to be miſtaken for original perceptions. The Biſhop of CLOYNE firſt furniſhed the world with the proper key for opening up theſe myſterious appearances; but he made conſiderable miſtakes in the application of it. Dr SMITH, in his elaborate and judicious treatiſe of Optics, hath applied it to the apparent diſtance of objects ſeen with glaſſes, and to the apparent figure of the heavens, with ſuch happy ſucceſs, that there can be no more doubt about the cauſes of theſe phenomena.

SECT.

SECT. XXIII.

Of the ſigns uſed in other acquired perceptions.

THE diſtance of objects from the eye, is the moſt important leſſon in viſion. Many others are eaſily learned in conſequence of it. The diſtance of the object, joined with its viſible magnitude, is a ſign of its real magnitude: and the diſtance of the ſeveral parts of an object, joined with its viſible figure, becomes a ſign of its real figure. Thus, when I look at a globe, which ſtands before me, by the original powers of ſight I perceive only ſomething of a circular form, variouſly coloured. The viſible figure hath no diſtance from the eye, no convexity, nor hath it three dimenſions; even its length and breadth are incapable of being meaſured by inches, feet, or other linear meaſures. But when I have

learned to perceive the diſtance of every part of this object from the eye, this perception gives it convexity, and a ſpherical figure; and adds a third dimenſion to that which had but two before. The diſtance of the whole object makes me likewiſe perceive the real magnitude; for being accuſtomed to obſerve how an inch or a foot of length affects the eye at that diſtance, I plainly perceive by my eye the linear dimenſions of the globe, and can affirm with certainty that its diameter is about one foot and three inches.

It was ſhown in the ſeventh ſection of this chapter, that the viſible figure of a body may, by mathematical reaſoning, be inferred from its real figure, diſtance, and poſition, with regard to the eye: in like manner, we may, by mathematical reaſoning, from the viſible figure, together with the diſtance of the ſeveral parts of it from the eye, infer the real figure and poſition. But this laſt inference is not commonly made by mathematical reaſoning, nor indeed by reaſoning of any kind, but by cuſtom.

The original appearance which the colour of an object makes to the eye, is a ſenſation for which we have no name, becauſe it is uſed merely

merely as a ſign, and is never made an object of attention in common life: but this appearance, according to the different circumſtances, ſignifies various things. If a piece of cloth, of one uniform colour, is laid ſo that part of it is in the ſun, and part in the ſhade; the appearance of colour, in theſe different parts, is very different: yet we perceive the colour to be the ſame; we interpret the variety of appearance as a ſign of light and ſhade, and not as a ſign of real difference in colour. But if the eye could be ſo far deceived, as not to perceive the difference of light in the two parts of the cloth, we ſhould, in that caſe, interpret the variety of appearance to ſignify a variety of colour in the parts of the cloth.

Again, if we ſuppoſe a piece of cloth placed as before, but having the ſhaded part ſo much brighter in the colour, that it gives the ſame appearance to the eye as the more enlightened part; the ſameneſs of appearance will here be interpreted to ſignify a variety of colour, becauſe we ſhall make allowance for the effect of light and ſhade.

When the real colour of an object is known, the appearance of it indicates, in ſome circumſtances, the degree of light or ſhade; in others,

others, the colour of the circumambient bodies, whoſe rays are reflected by it; and in other circumſtances, it indicates the diſtance or proximity of the object, as was obſerved in the laſt ſection; and by means of theſe, many other things are ſuggeſted to the mind. Thus, an unuſual appearance in the colour of familiar objects may be the diagnoſtic of a diſeaſe in the ſpectator. The appearance of things in my room, may indicate ſunſhine or cloudy weather, the earth covered with ſnow, or blackened with rain. It hath been obſerved, that the colour of the ſky, in a piece of painting, may indicate the country of the painter, becauſe the Italian ſky is really of a different colour from the Flemiſh.

It was already obſerved, that the original and acquired perceptions which we have by our ſenſes, are the language of nature to man, which, in many reſpects, hath a great affinity to human languages. The inſtances which we have given of acquired perceptions, ſuggeſt this affinity, that as, in human languages, ambiguities are often found, ſo this language of nature in our acquired perceptions is not exempted from them. We have ſeen, in viſion particularly, that the ſame appearance to the eye, may, in different circumſtances, indicate different

different things. Therefore, when the circumſtances are unknown upon which the interpretation of the ſigns depends, their meaning muſt be ambiguous; and when the circumſtances are miſtaken, the meaning of the ſigns muſt alſo be miſtaken.

This is the caſe in all the phenomena which we call *fallacies of the ſenſes;* and particularly, in thoſe which are called *fallacies in viſion.* The appearance of things to the eye, always correſponds to the fixed laws of nature; therefore, if we ſpeak properly, there is no fallacy in the ſenſes. Nature always ſpeaketh the ſame language, and uſeth the ſame ſigns in the ſame circumſtances: but we ſometimes miſtake the meaning of the ſigns, either through ignorance of the laws of nature, or through ignorance of the circumſtances which attend the ſigns.

To a man, unacquainted with the principles of optics, almoſt every experiment that is made with the priſm, with the magic lanthorn, with the teleſcope, with the microſcope, ſeems to produce ſome fallacy in viſion. Even the appearance of a common mirror, to one altogether unacquainted with the effects of it, would ſeem moſt remarkably fallacious.

For

For how can a man be more impoſed upon, than in ſeeing that before him which is really behind him? How can he be more impoſed upon, than in being made to ſee himſelf ſeveral yards removed from himſelf? Yet children, even before they can ſpeak their mother-tongue, learn not to be deceived by theſe appearances. Theſe, as well as all the other ſurpriſing appearances produced by optical glaſſes, are a part of the viſual language; and, to thoſe who underſtand the laws of nature concerning light and colours, are in no wiſe fallacious, but have a diſtinct and true meaning.

SECT.

SECT. XXIV.

Of the analogy between perception, and the credit we give to human teſtimony.

THE objects of human knowledge are innumerable, but the channels by which it is conveyed to the mind are few. Among theſe, the perception of external things by our ſenſes, and the informations which we receive upon human teſtimony, are not the leaſt conſiderable: and ſo remarkable is the analogy between theſe two, and the analogy between the principles of the mind, which are ſubſervient to the one, and thoſe which are ſubſervient to the other, without further apology, we ſhall conſider them together.

In the teſtimony of nature given by the ſenſes, as well as in human teſtimony given by language, things are ſignified to us by ſigns: and in one, as well as the other, the mind, either

ther by original principles, or by cuſtom, paſſes from the ſign to the conception and belief of the things ſignified.

We have diſtinguiſhed our perceptions into original and acquired; and language, into natural and artificial. Between acquired perception, and artificial language, there is a great analogy; but ſtill a greater between original perception and natural language.

The ſigns in original perception are ſenſations, of which nature hath given us a great variety, ſuited to the variety of the things ſignified by them. Nature hath eſtabliſhed a real connection between the ſigns and the things ſignified; and nature hath alſo taught us the interpretation of the ſigns; ſo that, previous to experience, the ſign ſuggeſts the thing ſignified, and creates the belief of it.

The ſigns in natural language are features of the face, geſtures of the body, and modulations of the voice; the variety of which is ſuited to the variety of the things ſignified by them. Nature hath eſtabliſhed a real connection between theſe ſigns, and the thoughts and diſpoſitions of the mind which are ſignified by them; and nature hath taught us the interpretation of theſe ſigns; ſo that, previous

vious to experience, the ſigns ſuggeſt the thing ſignified, and creates the belief of it.

A man in company, without doing good or evil, without uttering an articulate ſound, may behave himſelf gracefully, civilly, politely; or, on the contrary, meanly, rudely, and impertinently. We ſee the diſpoſitions of his mind, by their natural ſigns in his countenance and behaviour, in the ſame manner as we perceive the figure and other qualities of bodies by the ſenſations which nature hath connected with them.

The ſigns in the natural language of the human countenance and behaviour, as well as the ſigns in our original perceptions, have the ſame ſignification in all climates, and in all nations; and the ſkill of interpreting them is not acquired, but innate.

In acquired perception, the ſigns are either ſenſations, or things which we perceive by means of ſenſations. The connection between the ſign, and the thing ſignified, is eſtabliſhed by nature: and we diſcover this connection by experience; but not without the aid of our original perceptions, or of thoſe which we have already acquired. After this connection is diſcovered, the ſign, in like manner as in original perception, always ſuggeſts the

the things ſignified, and creates the belief of it.

In artificial language, the ſigns are articulate ſounds, whoſe connection with the things ſignified by them is eſtabliſhed by the will of men: and in learning our mother-tongue, we diſcover this connection by experience; but not without the aid of natural language, or of what we had before attained of artificial language. And after this connection is diſcovered, the ſign, as in natural language, always ſuggeſts the thing ſignified, and creates the belief of it.

Our original perceptions are few, compared with the acquired; but without the former, we could not poſſibly attain the latter. In like manner, natural language is ſcanty, compared with artificial; but without the former, we could not poſſibly attain the latter.

Our original perceptions, as well as the natural language of human features and geſtures, muſt be reſolved into particular principles of the human conſtitution. Thus, it is by one particular principle of our conſtitution, that certain features expreſs anger; and by another particular principle, that certain features expreſs benevolence. It is in like manner, by one particular principle of our conſtitution,

conſtitution, that a certain ſenſation ſignifies hardneſs in the body which I handle; and it is by another particular principle, that a certain ſenſation ſignifies motion in that body.

But our acquired perceptions, and the information we receive by means of artificial language, muſt be reſolved into general principles of the human conſtitution. When a painter perceives, that this picture is the work of Raphael, that the work of Titian; a jeweller, that this is a true diamond, that a counterfeit; a ſailor, that this is a ſhip of five hundred ton, that of four hundred: theſe different acquired perceptions are produced by the ſame general principles of the human mind, which have a different operation in the ſame perſon, according as they are variouſly applied, and in different perſons, according to the diverſity of their education and manner of life. In like manner, when certain articulate ſounds convey to my mind the knowledge of the battle of Pharſalia; and others, the knowledge of the battle of Poltowa; when a Frenchman and an Engliſhman receive the ſame information by different articulate ſounds; the ſigns uſed in theſe different caſes, produce the knowledge and belief of the things ſignified, by means of the ſame

general principles of the human conſtitution.

Now, if we compare the general principles of our conſtitution, which fit us for receiving information from our fellow-creatures by language, with the general principles which fit us for acquiring the perception of things by our ſenſes, we ſhall find them to be very ſimilar in their nature and manner of operation.

When we begin to learn our mother-tongue, we perceive by the help of natural language, that they who ſpeak to us, uſe certain ſounds to expreſs certain things: we imitate the ſame ſounds when we would expreſs the ſame things, and find that we are underſtood.

But here a difficulty occurs which merits our attention, becauſe the ſolution of it leads to ſome original principles of the human mind, which are of great importance, and of very extenſive influence. We know by experience, that men *have* uſed ſuch words to expreſs ſuch things. But all experience is of the *paſt*, and can, of itſelf, give no notion or belief of what is *future*. How come we then to believe, and to rely upon it with aſſurance, that men who have it in their power to do otherwiſe, will continue to uſe the ſame words when

when they think the ſame things? Whence comes this knowledge and belief, this foreſight we ought rather to call it, of the future and voluntary actions of our fellow-creatures? Have they promiſed that they will never impoſe upon us by equivocation or falſehood? No, they have not. And, if they had, this would not ſolve the difficulty: for ſuch promiſe muſt be expreſſed by words, or by other ſigns; and, before we can rely upon it, we muſt be aſſured, that they put the uſual meaning upon the ſigns which expreſs that promiſe. No man of common ſenſe ever thought of taking a man's own word for his honeſty; and it is evident that we take his veracity for granted, when we lay any ſtreſs upon his word or promiſe. I might add, that this reliance upon the declarations and teſtimony of men, is found in children long before they know what a promiſe is.

There is, therefore, in the human mind an early anticipation, neither derived from experience, nor from reaſon, nor from any compact or promiſe, that our fellow-creatures will uſe the ſame ſigns in language, when they have the ſame ſentiments.

This is, in reality, a kind of preſcience of human actions; and it ſeems to me to be an

original principle of the human conſtitution, without which we ſhould be incapable of language, and conſequently incapable of inſtruction.

The wiſe and beneficent Author of nature, who intended that we ſhould be ſocial creatures, and that we ſhould receive the greateſt and moſt important part of our knowledge by the information of others, hath, for theſe purpoſes, implanted in our natures two principles that tally with each other.

The firſt of theſe principles is, a propenſity to ſpeak truth, and to uſe the ſigns of language, ſo as to convey our real ſentiments. This principle has a powerful operation, even in the greateſt liars; for, where they lie once, they ſpeak truth a hundred times. Truth is always uppermoſt, and is the natural iſſue of the mind. It requires no art or training, no inducement or temptation, but only that we yield to a natural impulſe. Lying, on the contrary, is doing violence to our nature; and is never practiſed, even by the worſt men, without ſome temptation. Speaking truth is like uſing our natural food, which we would do from appetite, although it anſwered no end; but lying is like taking phyſic, which is nauſeous to the taſte, and which no man

man takes but for ſome end which he cannot otherwiſe attain.

If it ſhould be objected, That men may be influenced by moral or political conſiderations to ſpeak truth, and therefore, that their doing ſo, is no proof of ſuch an original principle as we have mentioned; I anſwer, firſt, That moral or political conſiderations can have no influence, until we arrive at years of underſtanding and reflection; and it is certain from experience, that children keep to truth invariably, before they are capable of being influenced by ſuch conſiderations. Secondly, When we are influenced by moral or political conſiderations, we muſt be conſcious of that influence, and capable of perceiving it upon reflection. Now, when I reflect upon my actions moſt attentively, I am not conſcious, that, in ſpeaking truth, I am influenced on ordinary occaſions by any motive moral or political. I find, that truth is always at the door of my lips, and goes forth ſpontaneouſly, if not held back. It requires neither good nor bad intention to bring it forth, but only that I be artleſs and undeſigning. There may, indeed, be temptations to falſehood, which would be too ſtrong for the natural principle of veracity, unaided by principles of

honour or virtue; but where there is no ſuch temptation, we ſpeak truth by inſtinct; and this inſtinct is the principle I have been explaining.

By this inſtinct, a real connection is formed between our words and our thoughts, and thereby the former become fit to be ſigns of the latter, which they could not otherwiſe be. And although this connection is broken in every inſtance of lying and equivocation, yet theſe inſtances being comparatively few, the authority of human teſtimony is only weakened by them, but not deſtroyed.

Another original principle implanted in us by the Supreme Being, is a diſpoſition to confide in the veracity of others, and to believe what they tell us. This is the counter-part to the former; and as that may be called *the principle of veracity*, we ſhall, for want of a more proper name, call this *the principle of credulity*. It is unlimited in children, until they meet with inſtances of deceit and falſehood: and it retains a very conſiderable degree of ſtrength through life.

If nature had left the mind of the ſpeaker *in æquilibrio*, without any inclination to the ſide of truth more than to that of falſehood; children would lie as often as they ſpeak truth,

truth, until reaſon was ſo far ripened, as to ſuggeſt the imprudence of lying, or conſcience, as to ſuggeſt its immorality. And, if nature had left the mind of the hearer *in æquilibrio*, without any inclination to the ſide of belief more than to that of diſbelief, we ſhould take no man's word until we had poſitive evidence that he ſpoke truth. His teſtimony would, in this caſe, have no more authority than his dreams; which may be true or falſe, but no man is diſpoſed to believe them, on this account, that they were dreamed. It is evident, that, in the matter of teſtimony, the balance of human judgment is by nature inclined to the ſide of belief; and turns to that ſide of itſelf, when there is nothing put into the oppoſite ſcale. If it was not ſo, no propoſition that is uttered in diſcourſe would be believed, until it was examined and tried by reaſon; and moſt men would be unable to find reaſons for believing the thouſandth part of what is told them. Such diſtruſt and incredulity would deprive us of the greateſt benefits of ſociety, and place us in a worſe condition than that of ſavages.

Children, on this ſuppoſition, would be abſolutely incredulous; and therefore abſolutely incapable of inſtruction: thoſe who had

little knowledge of human life, and of the manners and characters of men, would be in the next degree incredulous: and the moſt credulous men would be thoſe of greateſt experience, and of the deepeſt penetration; becauſe, in many caſes, they would be able to find good reaſons for believing teſtimony, which the weak and the ignorant could not diſcover.

In a word, if credulity were the effect of reaſoning and experience, it muſt grow up and gather ſtrength, in the ſame proportion as reaſon and experience do. But, if it is the gift of nature, it will be ſtrongeſt in childhood, and limited and reſtrained by experience; and the moſt ſuperficial view of human life ſhows, that the laſt is really the caſe, and not the firſt.

It is the intention of nature, that we ſhould be carried in arms before we are able to walk upon our legs; and it is likewiſe the intention of nature, that our belief ſhould be guided by the authority and reaſon of others, before it can be guided by our own reaſon. The weakneſs of the infant, and the natural affection of the mother, plainly indicate the former; and the natural credulity of youth, and authority of age, as plainly indicate the latter.

latter. The infant, by proper nurſing and care, acquires ſtrength to walk without ſupport. Reaſon hath likewiſe her infancy, when ſhe muſt be carried in arms: then ſhe leans entirely upon authority, by natural inſtinct, as if ſhe was conſcious of her own weakneſs; and without this ſupport, ſhe becomes vertiginous. When brought to maturity by proper culture, ſhe begins to feel her own ſtrength, and leans leſs upon the reaſon of others; ſhe learns to ſuſpect teſtimony in ſome caſes, and to diſbelieve it in others; and ſets bounds to that authority to which ſhe was at firſt entirely ſubject. But ſtill, to the end of life, ſhe finds a neceſſity of borrowing light from teſtimony, where ſhe has none within herſelf, and of leaning in ſome degree upon the reaſon of others, where ſhe is conſcious of her own imbecillity.

And as in many inſtances, Reaſon, even in her maturity, borrows aid from teſtimony; ſo in others ſhe mutually gives aid to it, and ſtrengthens its authority. For as we find good reaſon to reject teſtimony in ſome caſes, ſo in others we find good reaſon to rely upon it with perfect ſecurity, in our moſt important concerns. The character, the number, and the diſintereſted-

neſs

neſs of witneſſes, the impoſſibility of colluſion, and the incredibility of their concurring in their teſtimony without colluſion, may give an irreſiſtible ſtrength to teſtimony, compared to which its native and intrinſic authority is very inconſiderable.

Having now conſidered the general principles of the human mind which fit us for receiving information from our fellow-creatures, by the means of language; let us next conſider the general principles which fit us for receiving the information of nature by our acquired perceptions.

It is undeniable, and indeed is acknowledged by all, that when we have found two things to have been conſtantly conjoined in the courſe of nature, the appearance of one of them is immediately followed by the conception and belief of the other. The former becomes a natural ſign of the latter; and the knowledge of their conſtant conjunction in time paſt, whether got by experience or otherwiſe, is ſufficient to make us rely with aſſurance upon the continuance of that conjunction.

This proceſs of the human mind is ſo familiar, that we never think of inquiring into the principles upon which it is founded.

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We are apt to conceive it as a ſelf-evident truth, that what is to come muſt be ſimilar to what is paſt. Thus if a certain degree of cold freezes water to-day, and has been known to do ſo in all time paſt, we have no doubt but the ſame degree of cold will freeze water to-morrow, or a year hence. That this is a truth which all men believe as ſoon as they underſtand it, I readily admit; but the queſtion is, Whence does its evidence ariſe? Not from comparing the ideas, ſurely. For when I compare the idea of cold with that of water hardened into a tranſparent ſolid body, I can perceive no connection between them: no man can ſhow the one to be the neceſſary effect of the other: no man can give a ſhadow of reaſon why nature hath conjoined them. But do we not learn their conjunction from experience? True; experience informs us that they have been conjoined in time *paſt:* but no man ever had any experience of what is *future:* and this is the very queſtion to be reſolved, How we come to believe that the *future* will be like the *paſt?* Hath the Author of Nature promiſed this? Or were we admitted to his council, when he eſtabliſhed the preſent laws of nature, and determined the time of their continuance?

continuance? No, ſurely. Indeed, if we believe that there is a wiſe and good Author of Nature, we may ſee a good reaſon, why he ſhould continue the ſame laws of nature, and the ſame connections of things, for a long time: becauſe, if he did otherwiſe, we could learn nothing from what is paſt, and all our experience would be of no uſe to us. But though this conſideration, when we come to the uſe of reaſon, may confirm our belief of the continuance of the preſent courſe of nature, it is certain that it did not give riſe to this belief; for children and idiots have this belief as ſoon as they know that fire will burn them. It muſt therefore be the effect of inſtinct, not of reaſon.

The wiſe Author of our nature intended, that a great and neceſſary part of our knowledge ſhould be derived from experience, before we are capable of reaſoning, and he hath provided means perfectly adequate to this intention. For, firſt, He governs nature by fixed laws, ſo that we find innumerable connections of things which continue from age to age. Without this ſtability of the courſe of nature, there could be no experience; or, it would be a falſe guide, and lead us into error and miſchief. If there were not a principle

ciple of veracity in the human mind, men's words would not be ſigns of their thoughts: and if there were no regularity in the courſe of nature, no one thing could be a natural ſign of another. Secondly, He hath implanted in human minds an original principle by which we believe and expect the continuance of the courſe of nature, and the continuance of thoſe connections which we have obſerved in time paſt. It is by this general principle of our nature, that when two things have been found connected in time paſt, the appearance of the one produces the belief of the other.

I think the ingenious author of the *Treatiſe of Human Nature* firſt obſerved, That our belief of the continuance of the laws of nature cannot be founded either upon knowledge or probability: but, far from conceiving it to be an original principle of the mind, he endeavours to account for it from his favourite hypotheſis, That belief is nothing but a certain degree of vivacity in the idea of the thing believed. I made a remark upon this curious hypotheſis in the ſecond chapter, and ſhall now make another.

The belief which we have in perception, is a belief of the preſent exiſtence of the object;

ject; that which we have in memory, is a belief of its paſt exiſtence; the belief of which we are now ſpeaking, is a belief of its future exiſtence, and in imagination there is no belief at all. Now, I would gladly know of this author, how one degree of vivacity fixes the exiſtence of the object to the preſent moment; another carries it back to time paſt; a third, taking a contrary direction, carries it into futurity; and a fourth carries it out of exiſtence altogether. Suppoſe, for inſtance, that I ſee the ſun riſing out of the ſea; I remember to have ſeen him riſe yeſterday; I believe he will riſe to-morrow near the ſame place; I can likewiſe imagine him riſing in that place, without any belief at all. Now, according to this ſceptical hypotheſis, this perception, this memory, this foreknowledge, and this imagination, are all the ſame idea, diverſified only by different degrees of vivacity. The perception of the ſun riſing, is the moſt lively idea; the memory of his riſing yeſterday, is the ſame idea a little more faint; the belief of his riſing to-morrow, is the ſame idea yet fainter; and the imagination of his riſing, is ſtill the ſame idea, but fainteſt of all. One is apt to think, that this idea might gradually paſs through all poſſible degrees

degrees of vivacity, without ſtirring out of its place. But if we think ſo, we deceive ourſelves; for no ſooner does it begin to grow languid, than it moves backward into time paſt. Suppoſing this to be granted, we expect at leaſt that as it moves backward by the decay of its vivacity, the more that vivacity decays, it will go back the farther, until it remove quite out of ſight. But here we are deceived again; for there is a certain period of this declining vivacity, when, as if it had met an elaſtic obſtacle in its motion backward, it ſuddenly rebounds from the paſt to the future, without taking the preſent in its way. And now having got into the regions of futurity, we are apt to think, that it has room enough to ſpend all its remaining vigour: but ſtill we are deceived; for, by another ſprightly bound, it mounts up into the airy region of imagination. So that ideas, in the gradual declenſion of their vivacity, ſeem to imitate the inflection of verbs in grammar. They begin with the preſent, and proceed in order to the preterite, the future, and the indefinite. This article of the ſceptical creed is indeed ſo full of myſtery, on whatever ſide we view it, that they who hold that creed, are very injuriouſly charged with incredulity:

ty: for to me it appears to require as much faith as that of St Athanaſius.

However, we agree with the author of the *Treatiſe of Human Nature* in this, That our belief of the continuance of nature's laws is not derived from reaſon. It is an inſtinctive preſcience of the operations of nature, very like to that preſcience of human actions which makes us rely upon the teſtimony of our fellow-creatures; and as, without the latter, we ſhould be incapable of receiving information from men by language; ſo, without the former, we ſhould be incapable of receiving the information of nature by means of experience.

All our knowledge of nature beyond our original perceptions, is got by experience, and conſiſts in the interpretation of natural ſigns. The conſtancy of nature's laws connects the ſign with the thing ſignified, and, by the natural principle juſt now explained, we rely upon the continuance of the connections which experience hath diſcovered; and thus the appearance of the ſign, is followed by the belief of the thing ſignified.

Upon this principle of our conſtitution, not only acquired perception, but all inductive reaſoning, and all our reaſoning from analogy,

analogy, is grounded: and, therefore, for want of another name, we ſhall beg leave to call it *the inductive principle*. It is from the force of this principle, that we immediately aſſent to that axiom upon which all our knowledge of nature is built, That effects of the ſame kind muſt have the ſame cauſe. For *effects* and *cauſes*, in the operations of nature, mean nothing but ſigns, and the things ſignified by them. We perceive no proper caſualty or efficiency in any natural cauſe; but only a connection eſtabliſhed by the courſe of nature between it and what is called its effect. Antecedently to all reaſoning, we have, by our conſtitution, an anticipation, that there is a fixed and ſteady courſe of nature; and we have an eager deſire to diſcover this courſe of nature. We attend to every conjunction of things which preſents itſelf, and expect the continuance of that conjunction. And when ſuch a conjunction has been often obſerved, we conceive the things to be naturally connected, and the appearance of one, without any reaſoning or reflection, carries along with it the belief of the other.

If any reader ſhould imagine that the inductive principle may be reſolved into what

philoſophers uſually call the *aſſociation of ideas*, let him obſerve, that, by this principle, natural ſigns are not aſſociated with the idea only, but with the belief of the things ſignified. Now, this can with no propriety be called an aſſociation of ideas, unleſs ideas and belief be one and the ſame thing. A child has found the prick of a pin conjoined with pain; hence he believes, and knows, that theſe things are naturally connected; he knows that the one will always follow the other. If any man will call this only an aſſociation of ideas, I diſpute not about words, but I think he ſpeaks very improperly. For if we expreſs it in plain Engliſh, it is a preſcience, that things which he hath found conjoined in time paſt, will be conjoined in time to come. And this preſcience is not the effect of reaſoning, but of an original principle of human nature, which I have called *the inductive principle*.

This principle, like that of credulity, is unlimited in infancy, and gradually reſtrained and regulated as we grow up. It leads us often into miſtakes, but is of infinite advantage upon the whole. By it the child once burnt ſhuns the fire; by it, he likewiſe runs away from the ſurgeon, by whom he was inoculated. It

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is better that he ſhould do the laſt, than that he ſhould not do the firſt.

But the miſtakes we are led into by theſe two natural principles, are of a different kind. Men ſometimes lead us into miſtakes, when we perfectly underſtand their language, by ſpeaking lies. But nature never miſleads us in this way; her language is always true; and it is only by miſinterpreting it that we fall into error. There muſt be many accidental conjunctions of things, as well as natural connections; and the former are apt to be miſtaken for the latter. Thus, in the inſtance above mentioned, the child connected the pain of inoculation with the ſurgeon; whereas it was really connected with the inciſion only. Philoſophers, and men of ſcience, are not exempted from ſuch miſtakes; indeed all falſe reaſoning in philoſophy is owing to them: it is drawn from experience and analogy, as well as juſt reaſoning, otherwiſe it could have no veriſimilitude: but the one is an unſkilful and raſh, the other a juſt and legitimate, interpretation of natural ſigns. If a child, or a man of common underſtanding, were put to interpret a book of ſcience, wrote in his mother-tongue, how many blunders and miſtakes would he be apt to fall into? Yet he knows as much

of this language as is neceſſary for his manner of life.

The language of nature is the univerſal ſtudy; and the ſtudents are of different claſſes. Brutes, idiots, and children, employ themſelves in this ſtudy, and owe to it all their acquired perceptions. Men of common underſtanding make a greater progreſs, and learn, by a ſmall degree of reflection, many things of which children are ignorant.

Philoſophers fill up the higheſt form in this ſchool, and are critics in the language of nature. All theſe different claſſes have one teacher, Experience, enlightened by the inductive principle. Take away the light of this inductive principle, and Experience is as blind as a mole: ſhe may indeed feel what is preſent, and what immediately touches her; but ſhe ſees nothing that is either before or behind, upon the right hand or upon the left, future or paſt.

The rules of inductive reaſoning, or of a juſt interpretation of nature, as well as the fallacies by which we are apt to miſinterpret her language, have been, with wonderful ſagacity, delineated by the great genius of Lord Bacon: ſo that his *Novum organum* may juſtly be

be called *a grammar of the language of nature.* It adds greatly to the merit of this work, and atones for its defects, that at the time it was written, the world had not ſeen any tolerable model of inductive reaſoning, from which the rules of it might be copied. The arts of poetry and eloquence were grown up to perfection when ARISTOTLE deſcribed them; but the art of interpreting nature was yet *in embryo* when BACON delineated its manly features and proportions. ARISTOTLE drew his rules from the beſt models of thoſe arts that have yet appeared; but the beſt models of inductive reaſoning that have yet appeared, which I take to be the third book of the *Principia* and the *Optics* of NEWTON, were drawn from BACON's rules. The purpoſe of all thoſe rules, is to teach us to diſtinguiſh ſeeming or apparent connections of things in the courſe of nature, from ſuch as are real.

They that are unſkilful in inductive reaſoning, are more apt to fall into error in their *reaſonings* from the phenomena of nature, than in their *acquired perceptions;* becauſe we often reaſon from a few inſtances, and thereby are apt to miſtake accidental conjunctions of things for natural connections: but that habit of paſſing, without reaſoning,

from the ſign to the thing ſignified, which conſtitutes acquired perception, muſt be learned by many inſtances or experiments; and the number of experiments ſerves to disjoin thoſe things which have been accidentally conjoined, as well as to confirm our belief of natural connections.

From the time that children begin to uſe their hands, nature directs them to handle every thing over and over, to look at it while they handle it, and to put it in various poſitions, and at various diſtances from the eye. We are apt to excuſe this as a childiſh diverſion, becauſe they muſt be doing ſomething, and have not reaſon to entertain themſelves in a more manly way. But if we think more juſtly, we ſhall find, that they are engaged in the moſt ſerious and important ſtudy; and if they had all the reaſon of a philoſopher, they could not be more properly employed. For it is this childiſh employment that enables them to make the proper uſe of their eyes. They are thereby every day acquiring habits of perception, which are of greater importance than any thing we can teach them. The original perceptions which nature gave them are few, and inſufficient for the purpoſes of life; and therefore ſhe made them capable of

of acquiring many more perceptions by habit. And to complete her work, ſhe hath given them an unwearied aſſiduity in applying to the exerciſes by which thoſe perceptions are acquired.

This is the education which nature gives to her children. And ſince we have fallen upon this ſubject, we may add, that another part of nature's education is, That, by the courſe of things, children muſt often exert all their muſcular force, and employ all their ingenuity, in order to gratify their curioſity, and ſatisfy their little appetites. What they deſire is only to be obtained at the expence of labour and patience, and many diſappointments. By the exerciſe of body and mind neceſſary for ſatisfying their deſires, they acquire agility, ſtrength, and dexterity in their motions, as well as health and vigour to their conſtitutions; they learn patience and perſeverance; they learn to bear pain without dejection, and diſappointment without deſpondence. The education of nature is moſt perfect in ſavages, who have no other tutor: and we ſee, that, in the quickneſs of all their ſenſes, in the agility of their motions, in the hardineſs of their conſtitutions, and in the ſtrength of their

minds to bear hunger, thirſt, pain, and diſappointment, they commonly far exceed the civilized. A moſt ingenious writer, on this account, ſeems to prefer the ſavage life to that of ſociety. But the education of nature could never of itſelf produce a Rousseau. It is the intention of nature, that human education ſhould be joined to her inſtitution, in order to form the man. And ſhe hath fitted us for human education, by the natural principles of imitation and credulity, which diſcover themſelves almoſt in infancy, as well as by others which are of later growth.

When the education which we receive from men, does not give ſcope to the education of nature, it is wrong directed; it tends to hurt our faculties of perception, and to enervate both the body and mind. Nature hath her way of rearing men, as ſhe hath of curing their diſeaſes. The art of medicine is to follow nature, to imitate and to aſſiſt her in the cure of diſeaſes; and the art of education is to follow Nature, to aſſiſt and to imitate her in her way of rearing men. The ancient inhabitants of the Baleares followed nature in the manner of teaching their children to be good archers, when they hung their dinner

dinner aloft by a thread, and left the younkers to bring it down by their ſkill in archery.

The education of nature, without any more human care than is neceſſary to preſerve life, makes a perfect ſavage. Human education, joined to that of nature, may make a good citizen, a ſkilful artiſan, or a well-bred man. But Reaſon and Reflection muſt ſuperadd their tutory, in order to produce a ROUSSEAU, a BACON, or a NEWTON.

Notwithſtanding the innumerable errors committed in human education, there is hardly any education ſo bad, as to be worſe than none. And I apprehend, that if even ROUSSEAU were to chooſe whether to educate a ſon among the French, the Italians, the Chineſe, or among the Eſkimaux, he would not give the preference to the laſt.

When Reaſon is properly employed, ſhe will confirm the documents of nature, which are always true and wholeſome; ſhe will diſtinguiſh, in the documents of human education, the good from the bad, rejecting the laſt with modeſty, and adhering to the firſt with reverence.

Moſt

Moſt men continue all their days to be juſt what nature and human education made them. Their manners, their opinions, their virtues, and their vices, are all got by habit, imitation, and inſtruction; and Reaſon has little or no ſhare in forming them.

CHAP.

CHAP. VII.

CONCLUSION.

Containing Reflections upon the opinions of Philoſophers on this ſubject.

THERE are two ways in which men may form their notions and opinions concerning the mind, and concerning its powers and operations. The firſt is the only way that leads to truth; but it is narrow and rugged, and few have entered upon it. The ſecond is broad and ſmooth, and hath been much beaten, not only by the vulgar, but even by philoſophers: it is ſufficient for common life, and is well adapted to the purpoſes of the poet and orator: but, in philoſophical diſquiſitions concerning the mind, it leads to error and deluſion.

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We may call the firſt of theſe ways, *the way of reflection.* When the operations of the mind are exerted, we are conſcious of them; and it is in our power to attend to them, and to reflect upon them, until they become familiar objects of thought. This is the only way in which we can form juſt and accurate notions of thoſe operations. But this attention and reflection is ſo difficult to man, ſurrounded on all hands by external objects, which conſtantly ſolicit his attention, that it has been very little practiſed, even by philoſophers. In the courſe of this Inquiry, we have had many occaſions to ſhow, how little attention hath been given to the moſt familiar operations of the ſenſes.

The ſecond, and the moſt common way, in which men form their opinions concerning the mind and its operations, we may call *the way of analogy.* There is nothing in the courſe of nature ſo ſingular, but we can find ſome reſemblance, or at leaſt ſome analogy, between it and other things with which we are acquainted. The mind naturally delights in hunting after ſuch analogies, and attends to them with pleaſure. From them, poetry and wit derive a great part of their charms; and

and eloquence, not a little of its perſuaſive force.

Beſides the pleaſure we receive from analogies, they are of very conſiderable uſe, both to facilitate the conception of things, when they are not eaſily apprehended without ſuch a handle, and to lead us to probable conjectures about their nature and qualities, when we want the means of more direct and immediate knowledge. When I conſider that the planet Jupiter, in like manner as the earth, rolls round his own axis, and revolves round the ſun, and that he is enlightened by ſeveral ſecondary planets, as the earth is enlightened by the moon; I am apt to conjecture from analogy, that as the earth by theſe means is fitted to be the habitation of various orders of animals, ſo the planet Jupiter is, by the like means, fitted for the ſame purpoſe: and having no argument more direct and concluſive to determine me in this point, I yield, to this analogical reaſoning, a degree of aſſent proportioned to its ſtrength. When I obſerve, that the potato plant very much reſembles the *ſolanum* in its flower and fructification, and am informed, that the laſt is poiſonous, I am apt from analogy to have ſome ſuſpicion of the former: but in this caſe, I have

have acceſs to more direct and certain evidence; and therefore ought not to truſt to analogy, which would lead me into an error.

Arguments from analogy are always at hand, and grow up ſpontaneouſly in a fruitful imagination, while arguments that are more direct, and more concluſive, often require painful attention and application: and therefore, mankind in general have been very much diſpoſed to truſt to the former. If one attentively examines the ſyſtems of the ancient philoſophers, either concerning the material world, or concerning the mind, he will find them to be built ſolely upon the foundation of analogy. Lord BACON firſt delineated the ſtrict and ſevere method of induction; ſince his time it has been applied with very happy ſucceſs in ſome parts of natural philoſophy; and hardly in any thing elſe. But there is no ſubject in which mankind are ſo much diſpoſed to truſt to the analogical way of thinking and reaſoning, as in what concerns the mind and its operations; becauſe, to form clear and diſtinct notions of thoſe operations in the direct and proper way, and to reaſon about them, requires a habit of attentive reflection, of which few are capable, and which, even

even by thoſe few, cannot be attained without much pains and labour.

Every man is apt to form his notions of things difficult to be apprehended, or leſs familiar, from their analogy to things which are more familiar. Thus, if a man bred to the ſeafaring life, and accuſtomed to think and talk only of matters relating to navigation, enters into diſcourſe upon any other ſubject; it is well known, that the language and the notions proper to his own profeſſion are infuſed into every ſubject, and all things are meaſured by the rules of navigation: and if he ſhould take it into his head to philoſophize concerning the faculties of the mind, it cannot be doubted, but he would draw his notions from the fabric of his ſhip, and would find in the mind, ſails, maſts, rudder, and compaſs.

Senſible objects of one kind or other, do no leſs occupy and engroſs the reſt of mankind, than things relating to navigation, the ſeafaring man. For a conſiderable part of life, we can think of nothing but the objects of ſenſe; and to attend to objects of another nature, ſo as to form clear and diſtinct notions of them, is no eaſy matter, even after we come to years of reflection. The condition

tion of mankind, therefore, affords good reaſon to apprehend, that their language, and their common notions, concerning the mind and its operations, will be analogical, and derived from the objects of ſenſe; and that theſe analogies will be apt to impoſe upon philoſophers, as well as upon the vulgar, and to lead them to materialize the mind and its faculties; and experience abundantly confirms the truth of this.

How generally men of all nations, and in all ages of the world, have conceived the ſoul, or thinking principle in man, to be ſome ſubtile matter, like breath or wind, the names given to it almoſt in all languages ſufficiently teſtify. We have words which are proper, and not analogical, to expreſs the various ways in which we perceive external objects by the ſenſes; ſuch as *feeling*, *ſight*, *taſte*: but we are often obliged to uſe theſe words analogically, to expreſs other powers of the mind which are of a very different nature. And the powers which imply ſome degree of reflection, have generally no names but ſuch as are analogical. The objects of thought are ſaid to be *in the mind*, to be *apprehended*, *comprehended*, *conceived*, *imagined*, *retained*, *weighed*, *ruminated*.

It

It does not appear that the notions of the ancient philoſophers, with regard to the nature of the ſoul, were much more refined than thoſe of the vulgar, or that they were formed in any other way. We ſhall diſtinguiſh the philoſophy that regards our ſubject into the *old* and the *new*. The old reached down to DES CARTES, who gave it a fatal blow, of which it has been gradually expiring ever ſince, and is now almoſt extinct. DES CARTES is the father of the new philoſophy that relates to this ſubject; but it hath been gradually improving ſince his time, upon the principles laid down by him. The old philoſophy ſeems to have been purely analogical: the new is more derived from reflection, but ſtill with a very conſiderable mixture of the old analogical notions.

Becauſe the objects of ſenſe conſiſt of *matter* and *form*, the ancient philoſophers conceived every thing to belong to one of theſe, or to be made up of both. Some therefore thought, that the ſoul is a particular kind of ſubtile matter, ſeparable from our groſs bodies; others thought that it is only a particular form of the body, and inſeparable from it. For there ſeem to have been ſome among the ancients, as well as among the moderns,

who conceived that a certain ſtructure or organization of the body, is all that is neceſſary to render it ſenſible and intelligent. The different powers of the mind were, accordingly, by the laſt ſect of philoſophers, conceived to belong to different parts of the body, as the heart, the brain, the liver, the ſtomach, the blood.

They who thought that the ſoul is a ſubtile matter ſeparable from the body, diſputed to which of the four elements it belongs, whether to earth, water, air, or fire. Of the three laſt, each had its particular advocates. But ſome were of opinion, that it partakes of all the elements; that it muſt have ſomething in its compoſition ſimilar to every thing we perceive; and that we perceive earth by the earthly part; water, by the watery part; and fire, by the fiery part of the ſoul. Some philoſophers, not ſatisfied with determining of what kind of matter the ſoul is made, inquired likewiſe into its figure, which they determined to be ſpherical, that it might be the more fit for motion. The moſt ſpiritual and ſublime notion concerning the nature of the ſoul, to be met with among the ancient philoſophers, I conceive to be that of the Platoniſts, who held, that it is made of that celeſtial

ſtial and incorruptible matter of which the fixed ſtars were made, and therefore has a natural tendency to rejoin its proper element. I am at a loſs to ſay, in which of theſe claſſes of philoſophers ARISTOTLE ought to be placed. He defines the ſoul to be, The firſt ἐντελεχεια of a natural body which has potential life. I beg to be excuſed from tranſlating the Greek word, becauſe I know not the meaning of it.

The notions of the ancient philoſophers with regard to the operations of the mind, particularly with regard to perceptions and ideas, ſeem likewiſe to have been formed by the ſame kind of analogy.

PLATO, of the writers that are extant, firſt introduced the word *idea* into philoſophy; but his doctrine upon this ſubject had ſomewhat peculiar. He agreed with the reſt of the ancient philoſophers in this, that all things conſiſt of matter and form; and that the matter of which all things were made, exiſted from eternity, without form: but he likewiſe believed, that there are eternal forms of all poſſible things which exiſt, without matter; and to theſe eternal and immaterial forms he gave the name of *ideas*; maintaining, that they are the only object of true

knowledge. It is of no great moment to us, whether he borrowed theſe notions from PARMENIDES, or whether they were the iſſue of his own creative imagination. The latter Platoniſts ſeem to have improved upon them, in conceiving thoſe ideas, or eternal forms of things, to exiſt, not of themſelves, but in the Divine Mind, and to be the models and patterns according to which all things were made:

Then liv'd the Eternal One, then, deep retir'd
In his unfathom'd eſſence, view'd at large
The uncreated images of things.

To theſe Platonic notions, that of MALEBRANCHE is very nearly allied. This author ſeems, more than any other, to have been aware of the difficulties attending the common hypotheſis concerning ideas, to wit, That ideas of all objects of thought are in the human mind; and therefore, in order to avoid thoſe difficulties, makes the ideas which are the immediate objects of human thought, to be the ideas of things in the Divine Mind; who being intimately preſent to every human mind, may diſcover his ideas to it, as far as pleaſeth him.

The

The Platoniſts and MALEBRANCHE excepted, all other philoſophers, as far as I know, have conceived that there are ideas or images of every object of thought in the human mind, or at leaſt in ſome part of the brain, where the mind is ſuppoſed to have its reſidence.

ARISTOTLE had no good affection to the word *idea*, and ſeldom or never uſes it but in refuting PLATO's notions about ideas. He thought that matter may exiſt without form; but that forms cannot exiſt without matter. But at the ſame time he taught, That there can be no ſenſation, no imagination, nor intellection, without forms, phantaſms, or ſpecies in the mind; and that things ſenſible are perceived by ſenſible ſpecies, and things intelligible by intelligible ſpecies. His followers taught more explicitly, that thoſe ſenſible and intelligible ſpecies are ſent forth by the objects, and make their impreſſions upon the paſſive intellect; and that the active intellect perceives them in the paſſive intellect. And this ſeems to have been the common opinion while the Peripatetic philoſophy retained its authority.

The Epicurean doctrine, as explained by LUCRETIUS, though widely different from the

Peripatetic in many things, is almoſt the ſame in this. He affirms, that ſlender films or ghoſts *(tenuia rerum ſimulacra)* are ſtill going off from all things and flying about; and that theſe being extremely ſubtile, eaſily penetrate our groſs bodies, and ſtriking upon the mind, cauſe thought and imagination.

After the Peripatetic ſyſtem had reigned above a thouſand years in the ſchools of Europe, almoſt without a rival, it ſunk before that of DES CARTES; the perſpicuity of whoſe writings and notions, contraſted with the obſcurity of ARISTOTLE and his commentators, created a ſtrong prejudice in favour of this new philoſophy. The characteriſtic of PLATO's genius was ſublimity, that of ARISTOTLE's, ſubtilty; but DES CARTES far excelled both in perſpicuity, and bequeathed this ſpirit to his ſucceſſors. The ſyſtem which is now generally received, with regard to the mind and its operations, derives not only its ſpirit from DES CARTES, but its fundamental principles; and after all the improvements made by MALEBRANCHE, LOCKE, BERKELEY, and HUME, may ſtill be called *the Carteſian ſyſtem:* we ſhall therefore make ſome remarks upon its ſpirit and tendency in general, and upon

upon its doctrine concerning ideas in particular.

1. It may be obſerved, That the method which DES CARTES purſued, naturally led him to attend more to the operations of the mind by accurate reflection, and to truſt leſs to analogical reaſoning upon this ſubject, than any philoſopher had done before him. Intending to build a ſyſtem upon a new foundation, he began with a reſolution to admit nothing but what was abſolutely certain and evident. He ſuppoſed that his ſenſes, his memory, his reaſon, and every other faculty to which we truſt in common life, might be fallacious; and reſolved to diſbelieve every thing, until he was compelled by irreſiſtible evidence to yield aſſent.

In this method of proceeding, what appeared to him, firſt of all, certain and evident, was, That he thought, that he doubted, that he deliberated. In a word, the operations of his own mind, of which he was conſcious, muſt be real, and no deluſion; and though all his other faculties ſhould deceive him, his conſciouſneſs could not. This therefore he looked upon as the firſt of all truths. This was the firſt firm ground upon which he ſet his foot, after being toſſed in the ocean of

ſcepticiſm; and he reſolved to build all knowledge upon it, without ſeeking after any more firſt principles.

As every other truth, therefore, and particularly the exiſtence of the objects of ſenſe, was to be deduced by a train of ſtrict argumentation from what he knew by conſciouſneſs, he was naturally led to give attention to the operations of which he was conſcious, without borrowing his notions of them from external things.

It was not in the way of analogy, but of attentive reflection, that he was led to obſerve, That thought, volition, remembrance, and the other attributes of the mind, are altogether unlike to extenſion, to figure, and to all the attributes of body; that we have no reaſon, therefore, to conceive thinking ſubſtances to have any reſemblance to extended ſubſtances; and that, as the attributes of the thinking ſubſtance are things of which we are conſcious, we may have a more certain and immediate knowledge of them by reflection, than we can have of external objects by our ſenſes.

Theſe obſervations, as far as I know, were firſt made by DES CARTES; and they are of more importance, and throw more light upon the ſubject, than all that had been ſaid upon it

it before. They ought to make us diffident and jealous of every notion concerning the mind and its operations, which is drawn from ſenſible objects in the way of analogy, and to make us rely only upon accurate reflection, as the ſource of all real knowledge upon this ſubject.

2. I obſerve, that as the Peripatetic ſyſtem has a tendency to materialize the mind, and its operations; ſo the Carteſian has a tendency to ſpiritualize body, and its qualities. One error, common to both ſyſtems, leads to the firſt of theſe extremes in the way of analogy, and to the laſt, in the way of reflection. The error I mean is, That we can know nothing about body, or its qualities, but as far as we have ſenſations, which reſemble thoſe qualities. Both ſyſtems agreed in this: but according to their different methods of reaſoning, they drew very different concluſions from it; the Peripatetic drawing his notions of ſenſation from the qualities of body; the Carteſian, on the contrary, drawing his notions of the qualities of body from his ſenſations.

The Peripatetic, taking it for granted that bodies and their qualities do really exiſt, and are ſuch as we commonly take them to be, inferred from them the nature of his ſenſations,

tions, and reaſoned in this manner: Our ſenſations are the impreſſions which ſenſible objects make upon the mind, and may be compared to the impreſſion of a ſeal upon wax; the impreſſion is the image or form of the ſeal, without the matter of it: in like manner, every ſenſation is the image or form of ſome ſenſible quality of the object. This is the reaſoning of ARISTOTLE, and it has an evident tendency to materialize the mind, and its ſenſations.

The Carteſian, on the contrary, thinks, that the exiſtence of body, or of any of its qualities, is not to be taken as a firſt principle; and that we ought to admit nothing concerning it, but what, by juſt reaſoning, can be deduced from our ſenſations; and he knows, that by reflection we can form clear and diſtinct notions of our ſenſations, without borrowing our notions of them by analogy from the objects of ſenſe. The Carteſians, therefore, beginning to give attention to their ſenſations, firſt diſcovered that the ſenſations correſponding to ſecondary qualities, cannot reſemble any quality of body. Hence, DES CARTES and LOCKE inferred, that ſound, taſte, ſmell, colour, heat, and cold, which the vulgar took to be qualities of body, were not qualities

qualities of body, but mere ſenſations of the mind. Afterwards the ingenious BERKELEY, conſidering more attentively the nature of ſenſation in general, diſcovered, and demonſtrated, that no ſenſation whatever could poſſibly reſemble any quality of an inſentient being, ſuch as body is ſuppoſed to be: and hence he inferred, very juſtly, that there is the ſame reaſon to hold extenſion, figure, and all the primary qualities, to be mere ſenſations, as there is to hold the ſecondary qualities to be mere ſenſations. Thus, by juſt reaſoning upon the Carteſian principles, matter was ſtript of all its qualities; the new ſyſtem, by a kind of metaphyſical ſublimation, converted all the qualities of matter into ſenſations, and ſpiritualized body, as the old had materialized ſpirit.

The way to avoid both theſe extremes, is, to admit the exiſtence of what we ſee and feel as a firſt principle, as well as the exiſtence of things whereof we are conſcious; and to take our notions of the qualities of body, from the teſtimony of our ſenſes, with the Peripatetics; and our notions of our ſenſations, from the teſtimony of conſciouſneſs, with the Carteſians.

3. I obſerve, That the modern ſcepticiſm is the natural iſſue of the new ſyſtem; and that, although it did not bring forth this monſter until the year 1739, it may be ſaid to have carried it in its womb from the beginning.

The old ſyſtem admitted all the principles of common ſenſe as firſt principles, without requiring any proof of them; and therefore, though its reaſoning was commonly vague, analogical, and dark, yet it was built upon a broad foundation, and had no tendency to ſcepticiſm. We do not find that any Peripatetic thought it incumbent upon him to prove the exiſtence of a material world; but every writer upon the Carteſian ſyſtem attempted this, until BERKELEY clearly demonſtrated the futility of their arguments; and thence concluded, that there was no ſuch thing as a material world; and that the belief of it ought to be rejected as a vulgar error.

The new ſyſtem admits only one of the principles of common ſenſe as a firſt principle; and pretends, by ſtrict argumentation, to deduce all the reſt from it. That our thoughts, our ſenſations, and every thing of which we are conſcious, hath a real exiſtence, is admitted in this ſyſtem as a firſt principle; but every thing elſe muſt be made evident by the light

light of reaſon. Reaſon muſt rear the whole fabric of knowledge upon this ſingle principle of conſciouſneſs.

There is a diſpoſition in human nature to reduce things to as few principles as poſſible; and this, without doubt, adds to the beauty of a ſyſtem, if the principles are able to ſupport what reſts upon them. The mathematicians glory, very juſtly, in having raiſed ſo noble and magnificent a ſyſtem of ſcience, upon the foundation of a few axioms and definitions. This love of ſimplicity, of reducing things to few principles, hath produced many a falſe ſyſtem; but there never was any ſyſtem in which it appears ſo remarkably as that of DES CARTES. His whole ſyſtem concerning matter and ſpirit is built upon one axiom, expreſſed in one word, *Cogito*. Upon the foundation of conſcious thought, with ideas for his materials, he builds his ſyſtem of the human underſtanding, and attempts to account for all its phenomena: And having, as he imagined, from his conſciouſneſs, proved the exiſtence of matter, and of a certain quantity of motion originally impreſſed upon it, he builds his ſyſtem of the material world, and attempts to account for all its phenomena.

Theſe

Theſe principles, with regard to the material ſyſtem, have been found inſufficient; and it has been made evident, that beſides matter and motion, we muſt admit gravitation, coheſion, corpuſcular attraction, magnetiſm, and other centripetal and centrifugal forces, by which the particles of matter attract and repel each other. NEWTON, having diſcovered this, and demonſtrated, that theſe principles cannot be reſolved into matter and motion, was led by analogy, and the love of ſimplicity, to conjecture, but with a modeſty and caution peculiar to him, that all the phenomena of the material world depended upon attracting and repelling forces in the particles of matter. But we may now venture to ſay, that this conjecture fell ſhort of the mark. For, even in the unorganized kingdom, the powers by which ſalts, cryſtals, ſpars, and many other bodies, concrete into regular forms, can never be accounted for by attracting and repelling forces in the particles of matter. And in the vegetable and animal kingdoms, there are ſtrong indications of powers of a different nature from all the powers of unorganized bodies. We ſee then, that although in the ſtructure of the material world there is, without doubt, all the beauti-

ful

ful ſimplicity conſiſtent with the purpoſes for which it was made, it is not ſo ſimple as the great DES CARTES determined it to be: nay, it is not ſo ſimple as the greater NEWTON modeſtly conjectured it to be. Both were miſled by analogy, and the love of ſimplicity. One had been much converſant about extenſion, figure, and motion; the other had enlarged his views to attracting and repelling forces; and both formed their notions of the unknown parts of nature, from thoſe with which they were acquainted, as the ſhepherd TITYRUS formed his notion of the city of Rome from his country village:

Urbem quam dicunt Romam, Melibœe, putavi
Stultus ego, huic noſtræ ſimilem, quò ſæpe ſolemus
Paſtores ovium teneros depellere fœtus.
Sic canibus catulos ſimiles, ſic matribus hœdos
Nôram: ſic parvis componere magna ſolebam.

This is a juſt picture of the analogical way of thinking.

But to come to the ſyſtem of DES CARTES, concerning the human underſtanding; it was built, as we have obſerved, upon conſciouſneſs as its ſole foundation, and with ideas as its materials; and all his followers have built upon

upon the ſame foundation, and with the ſame materials. They acknowledge that nature hath given us various ſimple ideas: Theſe are analogous to the matter of DES CARTES's phyſical ſyſtem. They acknowledge likewiſe a natural power by which ideas are compounded, disjoined, aſſociated, compared: This is analogous to the original quantity of motion in DES CARTES's phyſical ſyſtem. From theſe principles they attempt to explain the phenomena of the human underſtanding, juſt as in the phyſical ſyſtem the phenomena of nature were to be explained by matter and motion. It muſt indeed be acknowledged, that there is great ſimplicity in this ſyſtem as well as in the other. There is ſuch a ſimilitude between the two, as may be expected between children of the ſame father: but as the one has been found to be the child of DES CARTES, and not of nature, there is ground to think that the other is ſo likewiſe.

That the natural iſſue of this ſyſtem is ſcepticiſm with regard to every thing except the exiſtence of our ideas, and of their neceſſary relations which appear upon comparing them, is evident: for ideas being the only objects of thought, and having no exiſtence

ence but when we are conſcious of them, it neceſſarily follows, that there is no object of our thought which can have a continued and permanent exiſtence. Body and ſpirit, cauſe and effect, time and ſpace, to which we were wont to aſcribe an exiſtence independent of our thought, are all turned out of exiſtence by this ſhort dilemma: Either theſe things are ideas of ſenſation or reflection, or they are not: if they are ideas of ſenſation or reflection, they can have no exiſtence but when we are conſcious of them; if they are not ideas of ſenſation or reflection, they are words without any meaning.

Neither DES CARTES nor LOCKE perceived this conſequence of their ſyſtem concerning ideas. Biſhop BERKELEY was the firſt who diſcovered it. And what followed upon this diſcovery? Why, with regard to the material world, and with regard to ſpace and time, he admits the conſequence, That theſe things are mere ideas, and have no exiſtence but in our minds: but with regard to the exiſtence of ſpirits or minds, he does not admit the conſequence; and if he had admitted it, he muſt have been an abſolute ſceptic. But how does he evade this conſequence with regard to the exiſtence of ſpirits? The expedient

which the good Biſhop uſes on this occaſion is very remarkable, and ſhows his great averſion to ſcepticiſm. He maintains, that we have no ideas of ſpirits; and that we can think, and ſpeak, and reaſon about them, and about their attributes, without having any ideas of them. If this is ſo, my Lord, what ſhould hinder us from thinking and reaſoning about bodies, and their qualities, without having ideas of them? The Biſhop either did not think of this queſtion, or did not think fit to give any anſwer to it. However, we may obſerve, that in order to avoid ſcepticiſm, he fairly ſtarts out of the Carteſian ſyſtem, without giving any reaſon why he did ſo in this inſtance, and in no other. This indeed is the only inſtance of a deviation from Carteſian principles which I have met with in the ſucceſſors of DES CARTES; and it ſeems to have been only a ſudden ſtart, occaſioned by the terror of ſcepticiſm; for in all other things BERKELEY's ſyſtem is founded upon Carteſian principles.

Thus we ſee, that DES CARTES and LOCKE take the road that leads to ſcepticiſm, without knowing the end of it; but they ſtop ſhort for want of light to carry them farther. BERKELEY, frighted at the appearance of the dreadful

dreadful abyſs, ſtarts aſide, and avoids it. But the author of the *Treatiſe of Human Nature*, more daring and intrepid, without turning aſide to the right hand or to the left, like VIRGIL's Alecto, ſhoots directly into the gulf:

Hic ſpecus horrendum, et ſævi ſpiracula Ditis
Monſtrantur : ruptoque ingens Acheronte vorago
Peſtiferas aperit fauces.——

4. We may obſerve, That the account given by the new ſyſtem, of that furniture of the human underſtanding which is the gift of nature, and not the acquiſition of our own reaſoning faculty, is extremely lame and imperfect.

The natural furniture of the human underſtanding is of two kinds; Firſt, The *notions* or ſimple apprehenſions which we have of things: and, Secondly, The *judgments* or the belief which we have concerning them. As to our notions, the new ſyſtem reduces them to two claſſes; *ideas of ſenſation* and *ideas of reflection:* the firſt are conceived to be copies of our ſenſations, retained in the memory or imagination; the ſecond, to be copies of the operations of our minds where-

of we are conſcious, in like manner retained in the memory or imagination: and we are taught, that theſe two comprehend all the materials about which the human underſtanding is, or can be, employed. As to our judgment of things, or the belief which we have concerning them, the new ſyſtem allows no part of it to be the gift of nature, but holds it to be the acquiſition of reaſon, and to be got by comparing our ideas, and perceiving their agreements or diſagreements. Now I take this account, both of our notions, and of our judgments or belief, to be extremely imperfect; and I ſhall briefly point out ſome of its capital defects.

The diviſion of our notions into ideas of ſenſation, and ideas of reflection, is contrary to all rules of logic; becauſe the ſecond member of the diviſion includes the firſt. For, can we form clear and juſt notions of our ſenſations any other way than by reflection? Surely we cannot. Senſation is an operation of the mind of which we are conſcious; and we get the notion of ſenſation, by reflecting upon that which we are conſcious of. In like manner, doubting and believing are operations of the mind whereof we are conſcious; and we get the notion of them by reflecting

reflecting upon what we are conſcious of. The ideas of ſenſation, therefore, are ideas of reflection, as much as the ideas of doubting or believing, or any other ideas whatſoever.

But to paſs over the inaccuracy of this diviſion, it is extremely incomplete. For, ſince ſenſation is an operation of the mind, as well as all the other things of which we form our notions by reflection; when it is aſſerted, that all our notions are either ideas of ſenſation, or ideas of reflection, the plain Engliſh of this is, That mankind neither do, nor can think of any thing but of the operations of their own minds. Nothing can be more contrary to truth, or more contrary to the experience of mankind. I know that LOCKE, while he maintained this doctrine, believed the notions which we have of body and of its qualities, and the notions which we have of motion and of ſpace, to be ideas of ſenſation. But why did he believe this? Becauſe he believed thoſe notions to be nothing elſe but images of our ſenſations. If therefore the notions of body and its qualities, of motion and ſpace, be not images of our ſenſations, will it not follow, that thoſe notions are not ideas of ſenſation? Moſt certainly.

There is no doctrine in the new ſyſtem which more directly leads to ſcepticiſm than this. And the author of the *Treatiſe of Human Nature* knew very well how to uſe it for that purpoſe: for, if you maintain that there is any ſuch exiſtence as body or ſpirit, time or place, cauſe or effect, he immediately catches you between the horns of this dilemma; your notions of theſe exiſtences are either ideas of ſenſation, or ideas of reflection; if of ſenſation, from what ſenſation are they copied? if of reflection, from what operations of the mind are they copied?

It is indeed to be wiſhed, that thoſe who have written much about ſenſation, and about the other operations of the mind, had likewiſe thought and reflected much, and with great care, upon thoſe operations: but is it not very ſtrange, that they will not allow it to be poſſible for mankind to think of any thing elſe?

The account which this ſyſtem gives of our judgment and belief concerning things, is as far from the truth as the account it gives of our notions or ſimple apprehenſions. It repreſents our ſenſes as having no other office, but that of furniſhing the mind with notions or ſimple apprehenſions of things; and makes

our

our judgment and belief concerning thoſe things to be acquired by comparing our notions together, and perceiving their agreements or diſagreements.

We have ſhown, on the contrary, that every operation of the ſenſes, in its very nature, implies judgment or belief, as well as ſimple apprehenſion. Thus, when I feel the pain of the gout in my toe, I have not only a notion of pain, but a belief of its exiſtence, and a belief of ſome diſorder in my toe which occaſions it; and this belief is not produced by comparing ideas, and perceiving their agreements and diſagreements; it is included in the very nature of the ſenſation. When I perceive a tree before me, my faculty of ſeeing gives me not only a notion or ſimple apprehenſion of the tree, but a belief of its exiſtence, and of its figure, diſtance, and magnitude; and this judgment or belief is not got by comparing ideas, it is included in the very nature of the perception. We have taken notice of ſeveral original principles of belief in the courſe of this inquiry; and when other faculties of the mind are examined, we ſhall find more, which have not occurred in the examination of the five ſenſes.

Such original and natural judgments are therefore a part of that furniture which nature hath given to the human underſtanding. They are the inſpiration of the Almighty, no leſs than our notions or ſimple apprehenſions. They ſerve to direct us in the common affairs of life, where our reaſoning faculty would leave us in the dark. They are a part of our conſtitution, and all the diſcoveries of our reaſon are grounded upon them. They make up what is called *the common ſenſe of mankind;* and what is manifeſtly contrary to any of thoſe firſt principles, is what we call *abſurd.* The ſtrength of them is *good ſenſe*, which is often found in thoſe who are not acute in reaſoning. A remarkable deviation from them, ariſing from a diſorder in the conſtitution, is what we call *lunacy*; as when a man believes that he is made of glaſs. When a man ſuffers himſelf to be reaſoned out of the principles of common ſenſe, by metaphyſical arguments, we may call this *metaphyſical lunacy;* which differs from the other ſpecies of the diſtemper in this, that it is not continued, but intermittent: it is apt to ſeize the patient in ſolitary and ſpeculative moments; but when he enters into ſociety, Common Senſe recovers her authority. A clear explication

cation and enumeration of the principles of common ſenſe, is one of the chief *deſiderata* in logic. We have only conſidered ſuch of them as occurred in the examination of the five ſenſes.

5. The laſt obſervation that I ſhall make upon the new ſyſtem is, That, although it profeſſes to ſet out in the way of reflection, and not of analogy, it hath retained ſome of the old analogical notions concerning the operations of the mind; particularly, That things which do not now exiſt in the mind itſelf, can only be perceived, remembered, or imagined, by means of ideas or images of them in the mind, which are the immediate objects of perception, remembrance, and imagination. This doctrine appears evidently to be borrowed from the old ſyſtem; which taught, that external things make impreſſions upon the mind, like the impreſſions of a ſeal upon wax; that it is by means of thoſe impreſſions that we perceive, remember, or imagine them; and that thoſe impreſſions muſt reſemble the things from which they are taken. When we form our notions of the operations of the mind by analogy, this way of conceiving them ſeems to be very natural, and offers itſelf to our thoughts: for as every thing

thing which is felt muſt make ſome impreſſion upon the body, we are apt to think, that every thing which is underſtood muſt make ſome impreſſion upon the mind.

From ſuch analogical reaſoning, this opinion of the exiſtence of ideas or images of things in the mind, ſeems to have taken its riſe, and to have been ſo univerſally received among philoſophers. It was obſerved already, that Berkeley, in one inſtance, apoſtatizes from this principle of the new ſyſtem, by affirming, that we have no ideas of ſpirits, and that we can think of them immediately, without ideas. But I know not whether in this he has had any followers. There is ſome difference likewiſe among modern philoſophers, with regard to the ideas or images by which we perceive, remember, or imagine ſenſible things. For, though all agree in the exiſtence of ſuch images, they differ about their place; ſome placing them in a particular part of the brain, where the ſoul is thought to have her reſidence, and others placing them in the mind itſelf. DES CARTES held the firſt of theſe opinions; to which NEWTON ſeems likewiſe to have inclined; for he propoſes this query in his Optics: "Annon ſenſorium animalium "eſt locus cui ſubſtantia ſentiens adeſt, et in "quem

" quem ſenſibiles rerum ſpecies per nervos et " cerebrum deferuntur, ut ibi præſentes a " præſente ſentiri poſſint?" But LOCKE ſeems to place the ideas of ſenſible things in the mind: and that BERKELEY, and the author of the *Treatiſe of Human Nature*, were of the ſame opinion, is evident. The laſt makes a very curious application of this doctrine, by endeavouring to prove from it, That the mind either is no ſubſtance, or that it is an extended and diviſible ſubſtance; becauſe the ideas of extenſion cannot be in a ſubject which is indiviſible and unextended.

I confeſs I think his reaſoning in this, as in moſt caſes, is clear and ſtrong. For whether the idea of extenſion be only another name for extenſion itſelf, as BERKELEY and his author aſſert; or whether the idea of extenſion be an image and reſemblance of extenſion, as LOCKE conceived; I appeal to any man of common ſenſe, whether extenſion, or any image of extenſion, can be in an unextended and indiviſible ſubject. But while I agree with him in his reaſoning, I would make a different application of it. He takes it for granted, that there are ideas of extenſion in the mind; and thence infers, that if it is at all a ſubſtance, it muſt be an extended and diviſible

diviſible ſubſtance. On the contrary, I take it for granted, upon the teſtimony of common ſenſe, that my mind is a ſubſtance, that is, a permanent ſubject of thought; and my reaſon convinces me, that it is an unextended and indiviſible ſubſtance; and hence I infer, that there cannot be in it any thing that reſembles extenſion. If this reaſoning had occurred to BERKELEY, it would probably have led him to acknowledge, that we may think and reaſon concerning bodies, without having ideas of them in the mind, as well as concerning ſpirits.

I intended to have examined more particularly and fully this doctrine of the exiſtence of ideas or images of things in the mind; and likewiſe another doctrine, which is founded upon it, to wit, That judgment or belief is nothing but a perception of the agreement or diſagreement of our ideas: but having already ſhewn, through the courſe of this inquiry, that the operations of the mind which we have examined, give no countenance to either of theſe doctrines, and in many things contradict them, I have thought it proper to drop this part of my deſign. It may be executed with more advantage, if it is at all neceſſary, after inquiring into ſome other powers of the human underſtanding.

Although

Although we have examined only the five ſenſes, and the principles of the human mind which are employed about them, or ſuch as have fallen in our way in the courſe of this examination; we ſhall leave the further proſecution of this inquiry to future deliberation. The powers of memory, of imagination, of taſte, of reaſoning, of moral perception, the will, the paſſions, the affections, and all the active powers of the ſoul, preſent a vaſt and boundleſs field of philoſophical diſquiſition, which the author of this inquiry is far from thinking himſelf able to ſurvey with accuracy. Many authors of ingenuity, ancient and modern, have made excurſions into this vaſt territory, and have communicated uſeful obſervations: but there is reaſon to believe, that thoſe who have pretended to give us a map of the whole, have ſatisfied themſelves with a very inaccurate and incomplete ſurvey. If GALILEO had attempted a complete ſyſtem of natural philoſophy, he had, probably, done little ſervice to mankind: but by confining himſelf to what was within his comprehenſion, he laid the foundation of a ſyſtem of knowledge, which riſes by degrees, and does honour to the human underſtanding. NEWTON, building upon this foundation, and in like manner confining

confining his inquiries to the law of gravitation and the properties of light, performed wonders. If he had attempted a great deal more, he had done a great deal leſs, and perhaps nothing at all. Ambitious of following ſuch great examples, with unequal ſteps, alas! and unequal force, we have attempted an inquiry only into one little corner of the human mind; that corner which ſeems to be moſt expoſed to vulgar obſervation, and to be moſt eaſily comprehended; and yet, if we have delineated it juſtly, it muſt be acknowledged, that the accounts heretofore given of it, were very lame, and wide of the truth.

THE END.

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